GAROD

Radio

FOR THE EXTRA MEASURE

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GAROD RADIO

FOR THE EXTRA MEASURE OF VIEWING PLEASURE

TELEVISION SERVICE MANUAL
Price $1.00

TELEVISION RECEIVER MODELS

900 Series		920 Series
900 TV	10'' Direct View (Mahogany)	920 TV
910 TV	10'' Direct View (Bleached)	930 TV
1000 TV	12'' Direct View (Mahogany)	1020 TV
1010 TV	12'' Direct View (Bleached)	1030 TV

TABLE MODEL AM-FM RADIO & TELEVISION RECEIVER

900 Series		920 Series
1100 TVP	10'' Direct View (Mahogany)	1120 TVP
1110 TVP	10'' Direct View (Bleached)	1130 TVP
1200 TVP	12'' Direct View (Mahogany)	1220 TVP
1210 TVP	12'' Direct View (Bleached)	1230 TVP

FOUR-IN-ONE CONSOLE TELEVISION RECEIVER WITH AM-FM RADIO & AUTOMATIC

921 TVP 10'' Direct View (Mahogany)
1021 TVP 12'' Direct View (Bleached)

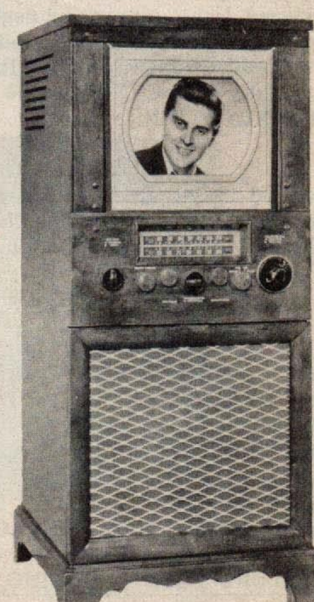
FOUR-IN-ONE CONSOLETTE TELEVISION RECEIVER WITH AM-FM RADIO & AUTOMATIC RECORD CHANGER

UPPER LEFT
MODEL 900TV

UPPER RIGHT
MODEL 1020TV

LOWER LEFT
MODEL 1200TVP

LOWER RIGHT
MODEL 921TVP



GAROD RADIO CORPORATION --- 70 Washington St., Brooklyn, 1, New York

Form #5102 Issue 1

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GENERAL DESCRIPTION:

Series 900, 920, and 921 Television Receivers listed on page 1 are similiar 28 tube Television Receivers using a 10" or 12" Picture tube. The table and Console Models are offered in a mahogany cabinet finish and the Consolette 10" or 12" Models in mahogany only.

All receivers are complete in one unit and are operated by the use of ten front panel controls (3 dual). Features of the receivers include: AM-FM reception from separate tuning dial (900 Series round, 920 Series slide rule type), full 12 channel coverage, FM sound system, provision for external phono connection available on all table models, Automatic Record Changer single speed 1200 series, dual speed changer for playing long playing or regular records Model 1200 and 921 Series; A-F-C Horizontal hold; and reduced hazard high voltage supply.

INSTALLATION:

The installation instruction sheet packed inside each receiver should be followed in setting up a receiver. The picture tube is shipped in a separate carton.

HIGH VOLTAGE WARNING

OPERATION OF THIS RECEIVER WITH INTERLOCKED BACK COVER REMOVED INVOLVES A SHOCK HAZARD FROM THE RECEIVER POWER SUPPLIES. WORK ON THIS RECEIVER SHOULD NOT BE ATTEMPTED BY ANYONE WHO IS NOT THOROUGHLY FAMILIAR WITH THE PRECAUTIONS NECESSARY WHEN WORKING ON HIGH VOLTAGE EQUIPMENT.

PICTURE TUBE HANDLING PRECAUTION:

Extreme care should be used in handling the picture tube. This picture tube bulb encloses a high vacuum and, due to its large surface area is subjected to considerable air pressure.

RECORD CHANGER DRAWER:

NOTE: Remove the copper plate screw at the rear of cabinet before sliding open the record changer drawer in setting up the Console or Consolette Models for use.

OPERATION:

(A) TELEVISION-TUNING IN A STATION: (Refer to Fig. 1 for 900 Series Operating Controls and Fig. 2 for 920 Series).

1. Turn the SELECTOR SWITCH knob to the "TELEV" position.
2. Turn the ON-OFF, VOLUME knob; a click will be heard, and the television channel indicator will be illuminated. (The television channel indicator is not illuminated on the Series 920 TV Receivers using the G. I. Tuner). Advance the "VOLUME" control to the right (clockwise) about half way.
3. Turn the STATION SELECTOR knob to the desired station.
4. Turn the CONTRAST control fully counterclockwise.
5. Turn the BRIGHTNESS control clockwise, until light is visible on the screen of the Picture tube.
6. Turn the CONTRAST control clockwise until activity or definite test pattern is noted on the screen.
7. Adjust the FINE TUNING control for best sound quality and VOLUME control for suitable volume.
8. Turn the VERTICAL control until the pattern stops moving up or down.

9. Turn the HORIZONTAL control until a picture is obtained and centered.

10. Adjust the CONTRAST control for suitable picture contrast.

11. Readjust the FINE TUNING control after the receiver has been on for some time for best sound quality.

12. When switching from one station to another it may be necessary to repeat steps 7 and 10.

(B) FREQUENCY MODULATION: A folded self-contained dipole antenna is provided at the rear of the cabinet for FM reception.

1. Turn the SELECTOR SWITCH to the "FM" position. The Television portion of the receiver is made inoperative in this position by switching off the B+.

2. Advance the VOLUME control about half way.

3. Turn the RADIO TUNING control knob slowly so that the dial pointer indicates the frequencey of the desired F-M station.

4. Rotate the RADIO TUNING control back and forth in tuning in the desired F-M station. Tune for best sound quality and minimum hiss. When a station is properly tuned in on this band, reception should be clear and free from hiss.

5. Adjust the VOLUME control to the desired listening level. The TONE control may be used to adjust the quality of reproduction desired.

(C) BROADCAST: A highly selective loop antenna is provided in the cabinet of the receiver for BROADCAST reception.

1. Turn the SELECTOR SWITCH to the "BC" position. The STANDARD BROADCAST or "AM" portion of the dial is not to be used.

2. Rotate the RADIO TUNING control to the desired station on the dial.

3. Adjust the VOLUME and TONE controls to the desired levels.

(D) RECORD CHANGER: (Applies to Consoles and Consolette Models only).

1. Set the SELECTOR SWITCH to the PHONO position. (Indicated by illumination of pilot lamp in changer compartment.

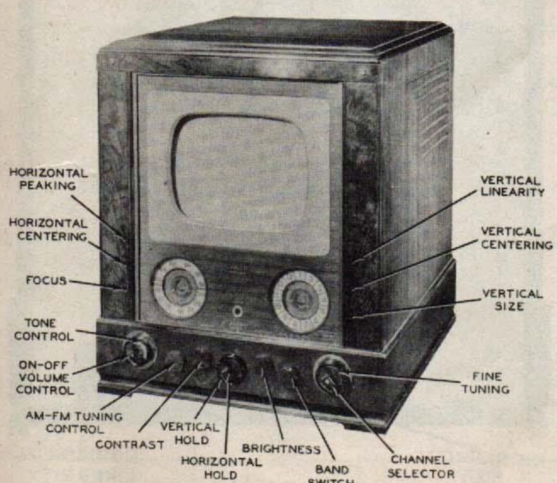
2. Open the Automatic Record Changer compartment. The pickup cartridge is automatically connected into the circuit for phono operation. Follow the record changer instructions accompanying each Console or Consolette Receiver in setting up the record changer for use.

NOTE: The 900 Series of Console Television Receivers uses a Seeburg Model L single speed record changer for playing standard 78RPM 10 or 12" records.

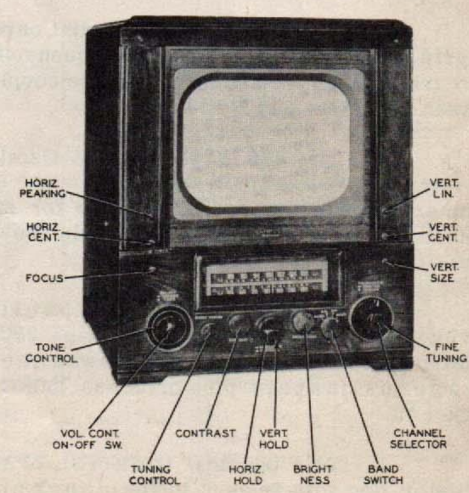
The 920 Series of Console Television Receivers uses a Webster Model 256 or General Instrument Model 700 FLP dual speed record changer for playing standard and LP records.

The Model 921 and 1021 Consolette Television Receivers use a Crescent Model M355A, General Instrument Model 700FLP or VM Model 400 dual speed record changer for playing standard and LP records. Service manuals are available on request.

The 900 and 920 Series of Table



Model 900TV



Model 1020TV

Model Television Receivers are equipped with a "PHONO" outlet receptacle for use in connecting a record player or record changer.

CIRCUIT DESCRIPTION: For ease in understanding the basic operation of the Television AM and FM portion of the receiver, a block diagram is shown below. (Reference is also made to the schematic diagram on pages 27, 28, 29).

TELEVISION-(A) RF TUNER

1. RCA R-F UNIT: The R-F unit is a separate complete sub-chassis of the receiver. On this sub-chassis are the R.F. Amplifier (6J6), Converter (6J6), Oscillator (6J6), Fine Tuning control, channel switch, converter transformer and trap, R.F. converter and oscillator coils and all their tuning adjustments. The tuner provides operation on all twelve of the present television channels. The tuner functions to select the desired picture and sound carriers, amplifies and converts to provide at the converter plate, a pix I.F. carrier frequency of 25.75 mc (900 Series) 24.75 (920 Series) and a sound I.F. carrier of 21.25 mc (900 Series) 20.25 mc (920 Series).

Each of the 6J6 (V1) Push-Pull R.F. Amplifier plate circuits employ a series of inductances which may be considered as a quarter wave section of a balanced transmission line which can be tuned over a band of frequencies by moving a switch shorting bar along the parallel conductors.

The adjustable wave traps are connected across the antenna input coil and may be tuned to eliminate F-M interference encountered in some areas.

The 6J6 (V2) Push-Pull Converter grid line operates in a similiar manner and is so arranged on the switch to provide coupling between converter and R-F line.

The 6J6 (V3) Push-Pull Oscillator line in each plate is similiar except that trimmer adjustments are provided for each channel and the low frequency coils are not Figure 8 windings.

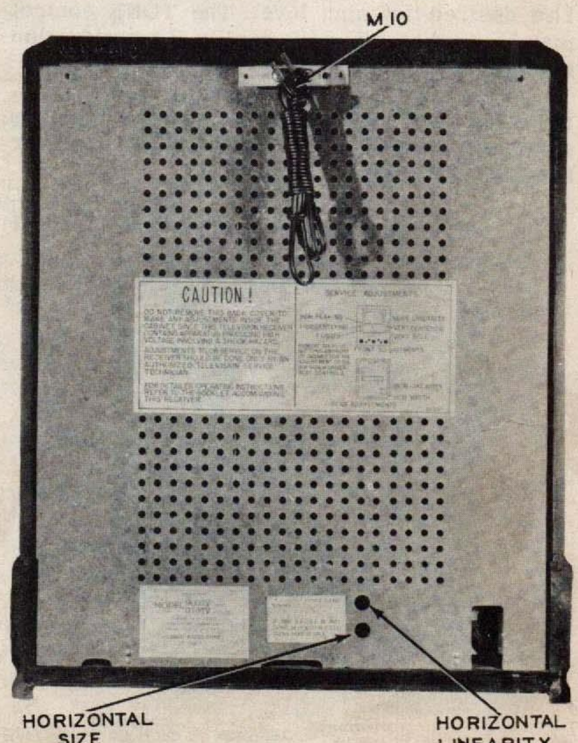
The fine Tuning capacitor provides approximately plus or minus 300KC variation of oscillator frequency on channel 1 and approximately plus or minus 750KC on channel 13.

The physical location of the oscillator line with respect to the converter grid line is such as to provide some coupling to the converter grids. This coupling is augmented by the link shown on the schematic and provides a reasonably uniform oscillator voltage at the converter grids over the entire tuning range of the tuner.

The converter transformer at the top of the tuner, is a combination picture I.F. transformer, sound trap, and sound I.F. Transformer. The converter I.F. plate coil is enclosed within the outer high "Q" sound trap, thereby the sound carrier is attenuated with reference to the Picture carrier.

Alignment of the circuits described above should be made in accordance with the instructions on pages 8 and 9.

2. SARKES TARZIAN R-F UNIT: This rotary switch type tuner is also a complete sub-chassis when used with the receiver. On this sub-chassis are mounted the 6BA6 R-F amplifier, 6AG5 converter, 6C4 oscillator, fine tuning control, channel switch, converter transformer, R-F converter and oscillator coils and all their tuning adjustments. The tuner provides operation on all twelve television channels. It also functions to select the desired picture and sound carriers, amplifies and converts to provide at the converter plate, a pix and sound I.F. carrier, frequencies listed below.



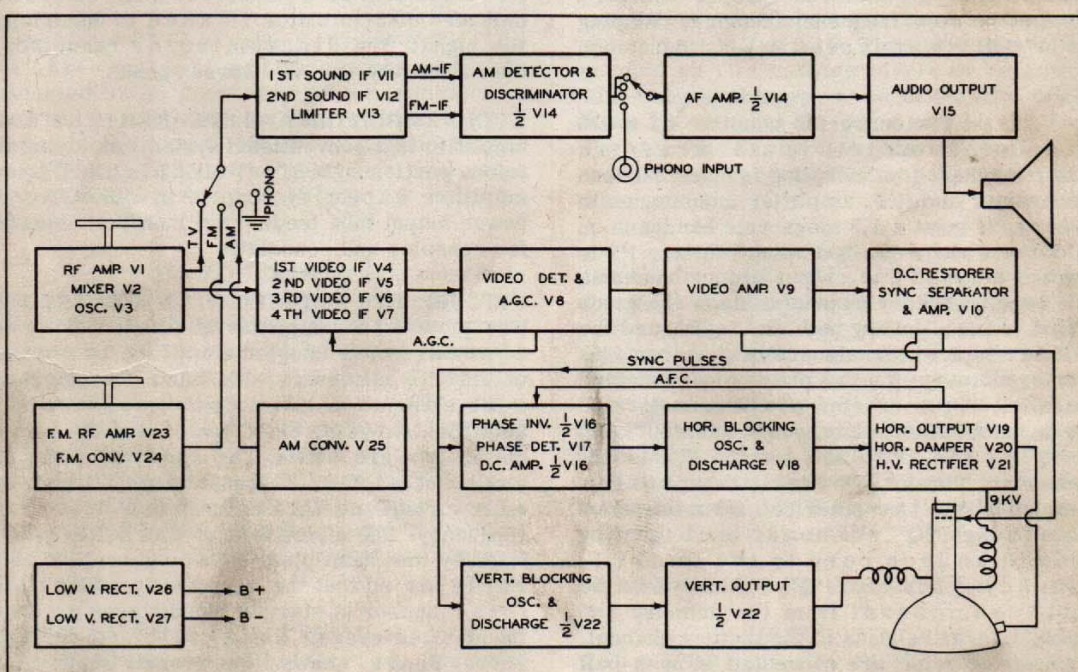
Rear Panel Adjustments

Referring to the schematic diagram on page 27 L1 is a center tapped iron core balanced input antenna coil used for matching a 300 ohm transmission line. It is also used for the short circuiting of low frequency signals which would otherwise be directly applied to the control grid of the 6BA6. Coils L3 and L4 are shunted across L1 on the high frequency channels. AGC voltage is applied to the grid of the 6BA6 thru resistor R11 and by passed by capacitor C13. The plate circuit of the 6BA6 is connected to one switch wafer on which are connected series inductances for all twelve channels. Adjustment of the starting inductance on channel 13 provides for correct bandpass from channels 12 thru 7. Adjusting the inductance of channel 6 provides for correct bandpass from channels 5 thru 2. The same bandpass adjustment procedure applies to the switch wafer connected to the grid of the 6AG5 thru capacitor C7 and grid resistor R6. Capacitors C4, C6, and C16 provide additional coupling which are arranged to produce a 6 mc. bandpass on each channel with damping resistors R5 and R12. Transformer T1 in the plate circuit of the 6AG5 is a combination pix I.F. transformer, sound trap and sound I. F. take-off transformer.

Two mycalex low loss switch wafers on which are wired individual oscillator inductances connected between the plate and grid of the 6C4 oscillator comprises the oscillator section. Each oscillator inductance from channel 13 thru 7 is adjustable by correct positioning of the single turn solid wire inductance. Adjustment of oscillator inductance from channel 6 thru 2 is made with a brass screw mounted in each coil. Capacitor C10 isolates D. C. voltage from the switch. Capacitor C9 provides reasonably uniform oscillator injection voltage to the converter grid over the entire tuning range of the tuner.

The fine tandem tuning capacitor is connected between the plate and grid of the 6C4. The variation of the fine tuning capacitor varies between 1mc. on channel 2 and 3 mc. on channel 13. Resistor R10 in the cathode of the 6C4 provides oscillator bias at all time.

3. GENERAL INSTRUMENT R-F UNIT: Used in Series 920 Receivers. This variable capacitance push-pull R-F tuner consists of a complete sub-chassis easily removable from the main chassis. On the tuner sub-chassis are the R-F Amplifier (6J6), Converter (6J6), Oscillator (6J6), fine tuning control, variable capacitors, converter transformer and trap, RF, converter, and oscillator coils for low and high frequency channels, trimmer capacitors, and adjustable wave traps. The tuner provides operation on all twelve of the television channels. It also functions to select the desired picture and sound carriers, amplifies and converts to provide



Block Diagram

at the converter plate, a pix I.F. carrier frequency of 24.75 mc and a sound I.F. carrier of 20.25 mc. The tuner is shock-mounted by means of rubber grommets from the main chassis to minimize microphonics.

Referring to the schematic diagram on page 27. L1 is a center tapped iron core balanced input antenna coil for matching a 300 ohm transmission line. It is also used for the short circuiting of low frequency signals which would otherwise be applied to the grids of the 6J6 R.F. Amplifier. Two adjustable wave traps are connected across the input coil and may be tuned to eliminate interference from the F-M band, (88 to 108 mc). AGC voltage is applied to the grids of the 6J6 thru resistor R4 and bypassed with capacitor (C4).

The R-F amplifier consists of a 6J6 over-coupled twin-triode. Capacity neutralization (C2) between plate and grid is employed. In the plate circuits of the 6J6 are connected separate low and high frequency inductances switched between separate low and high frequency tuning capacitors. A cam operated switch is used, coupled with the channel detent mechanism to switch into the circuit the appropriate coil and capacitor for low or high frequency channels. Trimmer capacitors on each section of the R.F. amplifier variable capacitors are used for adjusting to the correct bandpass curve. To obtain the proper bandpass curve for the low frequency channels damping resistor (R4) is connected across inductance (L2).

The converter consists of a 6J6 overcoupled twin triode and operates in a similiar manner. Link coupling is used between the converter and R.F. amplifier inductances to produce at least a 4.5 megacycle bandpass on each of the channels. Damping resistor R2 is connected across L3 to obtain proper bandpass on all low frequency channels. Since the grids are fed in push-pull by both the signal and the oscillator, the I.F. signals are in phase on the converter plates so the two plates are connected in parallel. The converter plate transformer L8 is a combination picture I.F. transformer, high "Q" sound trap and sound I.F. take-off transformer. The converter plate coil is assembled within the outer coil form on which is placed a high "Q" resonant coil tuned by means of an iron core to the sound I.F. frequency. This high "Q" coil absorbs the sound I.F. component from the primary and attenuates it with relation to the picture channel. The converter grids are connected in push-pull and the two plates in parallel. Resistor R8 and capacitor C4 connected at center tap of L3 and L6 to ground forms a series resonant circuit to prevent I.F. feedback in the converter by grounding its grids for I.F. frequency.

A 6J6 twin triode connected in push-pull as a negative resistance two terminal oscillator is used. Plate to grid feed back is provided by capacitor C5. Adjustable brass screws are provided within the high frequency (L7) or low frequency (L4) inductances. The brass screws are adjusted at channel 13 and channel 6. The heavy oscillator plates of the variable capacitor are shaped to track at all other channels.

The tandem fine tuning capacitor provides a trimmer range of approximately 1.75 mc on channel 2 and 5 mc on channel 13.

Link coupling from oscillator inductances L4 and L7 to the converter grid inductances L3 and L6 provides reasonably uniform oscillator injection voltage and converter bias at the converter grids over the entire tuning range of the tuner.

FM SOUND I.F. AMPLIFIER AND DISCRIMINATOR: A portion of the energy absorbed by the sound trap circuit transformer on the tuner is fed to the grid of the 6BA6 (V11) first sound amplifier. Three 20.25 mc (920 Series) or 21.25 mc (900 Series) stages of I.F. amplification are used to provide adequate sensitivity. The last I.F. stage acts as a limiter. A conventional balanced discriminator is used to demodulate the signal. The discriminator bandwidth is approximately 400 KC between peaks.

AUDIO AMPLIFIER AND SPEAKER: The audio amplifier is a conventional system employing the triode portion of a 6T8 (V14B) high MU triode amplifier capacity coupled to a 6K6GT (V15) power output tube feeding a 6 inch P.M. speaker for consoles and consolette

PICTURE I.F. AMPLIFIER AND DETECTOR: The picture I.F. amplifier is different from the conventional coupled amplifier. In order to obtain the necessary wide band characteristic with adequate gain, four stages of I.F. amplification using 6BA6 pentodes of the remote cut off type are used. The converter plate and each successive I.F. transformer utilizes one tuned circuit and each is tuned to a different frequency. The effective Q of each I.F. coil is fixed by the shunt plate load or grid damping resistor so that the response product of the total number of stagger tuned stages produces the desired overall bandwidth and response curve. Figure shows the overall shape of the quintuple combination. The input grids of 6BA6 V4, V5, and V6 are returned to a common bus to which variable gain control is applied; 6BA6

V7 operates at maximum gain. The cathodes of the controlled tubes are left unbypassed to minimize Miller effect. Transformer A19 is a bifilar winding which couples the last I.F. to the video and AGC 6AL5 V8 2nd detector.

To align the I.F. system, the transformers are peaked to the specified frequencies with a signal generator. The overall I.F. response is then observed by the use of a sweep generator and oscilloscope. Slight deviations from standard circuit Q are compensated for with shifts in transformer center frequency until the desired response curve is obtained.

The I.F. response curve does shift slightly as the contrast control is varied due to Miller effect and some regeneration. This effect is the change in tube input capacitance as its gain is varied by grid bias changes. The change of input capacitance causes a slight detuning of the preceding I.F. transformer and a small shift in response shape which is overcome by the proper setting of the CONTRAST control.

Because the overall bandwidth of the Picture I.F. system is maintained at 2.75 mc, one sound trap (on the tuner) is used, tuned to the accompaning sound I.F. frequency as described previously to attenuate the sound carrier.

The picture second detector consists of 1/2 of a 6AL5 (V8) whose plate is connected to the secondary of pix transformer A19. The second detector load consisting of peaking coil L13 and R46 in the cathode circuit provides a positive (sync going positive) video signal. C52 serves as a pix I.F. bypass capacitor.

The AGC Detector is capacitively coupled by (C50) to the secondary of Pix I.F. A19. A negative bias is developed across R44 depending upon the signal strength developed across the secondary of Pix I.F. A19. This bias is applied to the AGC bus through R45. C92 and C93 makeup the proper AGC time constant. Auxiliary manual control is provided by the contrast control by injecting a DC negative voltage in series with R36. This voltage causes more diode current to flow thus increasing the voltage drop across R45 which in turn reduces the gain of the pix I.F. chain.

VIDEO AMPLIFIER: This section of the receiver serves to amplify the video output of the second detector. The video amplifier consists of a single 6AC7 (V9) direct coupled to the video detector (V8). The 6AC7 is cathode biased with a small bypass capacitor (C53) providing degeneration of all but the higher video frequencies. This results in high frequency boost that appears as brightening of the fine detail portions of a picture. The video output load resistor consists of the parallel combination of resistors R51 and R52. Additional plate compensation is introduced by peaking coils L14, L15 and their respective damping resistors R 48, R49. The screen of the 6AC7 is returned to B+ 150 volts thru series resistor R50. This allows the screen voltage to drop when the control grid swings positive under overload conditions thus limiting the plate current to a safe value for proper operation of the tube.

D-C RESTORER, SYNC SEPARATOR AND SYNC AMPLIFIER: The video amplifier being an A-C amplifier, the D-C component of the video signal that represents the average illumination of the original transmitted picture will not be passed. Unless this D-C component is restored, difficulty will be experienced in maintaining proper picture illumination. For any given picture, this average illumination could be set properly by adjusting the BRIGHTNESS control. However a change in type of picture would require resetting the BRIGHTNESS control. The D-C restorer accomplishes this setting automatically thus assuring proper picture illumination at all times.

D-C restoration and sync separation occurs between the grid and cathode of the first half of V10. The video signal is then coupled to the cathode of V10 by resistor R53 which allows this portion of the tube to act as diode by virtue of the grounded grid, and the signal developed across R56 providing the necessary D-C reinsertion voltage for the picture tube.

Additional sync separation takes place in the plate circuit of V10 by virtue of operation at reduced voltage. The clipped sync pulses appearing at the grid of V10 (2nd half) are negative in polarity and must be inverted before they can be injected into the sweep oscillators. The signal at the grid of V10 is sufficient to drive the tube beyond cutoff and the signal is again clipped and amplified. This removes all amplitude variations between sync pulses due to hum, noise etc., and appears with the correct polarity at the plate of V10.

CATHODE RAY PICTURE TUBES:

(A) 10". The 10" Cathode Ray Tube (10BP4) used in all 900 and 920 series television receivers employs magnetic deflection and magnetic focus. A magnetic type beam bender is used to prevent the ion beam from producing a brown spot on the screen of the picture tube. The inside and outside of the flaring portion of the glass envelope are given a metallic coating. The inner coating, which is the second anode, is connected to the high voltage supply. The outer coating is grounded by means of two small springs on the Deflection Yoke support. The capacity between the two coatings is approximately 500 mmf and is used as a high voltage filter capacitor. 10'' aluminized tubes (10FP4) when used do not require the use of a beam bender.

(B) 12''. The 12'' Cathode Ray Tube (12JP4) used in all 1000 and 1020 series of television receivers is of the same type as the 10'' tube except for elimination of the beam bender. The 12LP4 when used requires the use of a beam bender.

INTEGRATING NETWORK: The purpose of this network is to separate the horizontal from the vertical sync and to pass the vertical to the vertical oscillator. Since the horizontal sync pulse is of short duration (5 micro seconds) and the vertical pulse is of much longer duration (190 micro seconds), they can be separated by an R-C filter which is responsive to wave shape. The Intergrating Network which is such a filter, is made up of resistors R106, R107 and capacitors C74, C75. In operation the vertical sync pulses developed across L59 are integrated by the integrating network which can be considered as a low pass filter which bypasses the narrow or high frequency horizontal sync but passes the broad or low frequency vertical sync pulses. The integrated sync pulse is then applied to the low side of the vertical blocking oscillator transformer T3 for triggering V22.

VERTICAL OSCILLATOR DISCHARGE AND OUTPUT: The function of these circuits is to provide a sawtooth of current of the proper frequency and phase to perform the vertical scanning for the picture tube. To produce such a current in the vertical deflection coil, a somewhat different shaped voltage wave is required. Since the vertical trace is slow, requiring about 16,000 micro-seconds, and the vertical deflection coil inductance is small, approximately 50 millihenries, the majority of the voltage across the coil during trace is across its resistive component. In order to produce a linear change of current thru a resistance, a linear change of voltage is necessary. Retrace, however, must be accomplished within the 666 microsecond vertical blanking time and therefore requires a much faster rate of change of current through the deflection coil. During this retrace time, the effect of its inductance becomes appeciable because of the required fast rate of change of current. It is therefore necessary to apply a large pulse of voltage across the deflection coil in order to obtain rapid retrace. The composite wave form required to produce a sawtooth of current in the deflection coil is a sawtooth of voltage with a sharp pulse. Tube V22 supplies such a voltage.

(a) Vertical oscillator and discharge: One half of a 6SN7 V22A, with its associated components form a blocking oscillator and discharge circuit with vertical hold resistor R38 in the grid circuit as the frequency adjustment and C113 as the discharge capacitor. R10 and R110 are the charging resistors thru which C113 charges during the vertical trace period. Adjustment of R10 changes the amplitude to which C113 may charge and thus serves as an adjustment of vertical size.

(b) Vertical output: One half of a 6 SN7 V22B, with its associated components forms the vertical output state. R8 is provided as a variable cathode bias resistor and allows adjustment of vertical sweep linearity.. Since the grid control characteristic curve of V22B is not a straight line over its entire range, the effect of adjusting R8 is to produce slight variations in shape of the sawtooth by shifting the operating point of the tube to different points along the curve. Since the slope of the curve varies at these different points and thus varies the effective gain of the tube, it is apparent that adjustments of linearity affect picture size and that such adjustments must be accompanied by readjustments of the size control R10. Adjustments of the size control affects the shape of sawtooth voltage on V22A plate so that any adjustments of vertical size must be accompanied by readjustment of linearity.

The vertical output transformer T5 matches the resistance of the vertical deflection coils to the plate impedance of V22B. 470 ohm resistors are connected across each winding of the vertical deflection coils to prevent ''ringing'' of the windings.

Vertical centering is achieved by passing a direct current thru the deflection coils. Center tapped control R9 permits reversing the polarity of this current as well as adjusting its amplitude. C13A and C13B are effectively in series with each other and bypass the resistance of the centering potentiomete. These electrolytic capacitors are so arranged (common positive) that at no time is D-C of incorrect polarity applied across them.

HORIZONTAL A.F.C. CIRCUITS, PHASE INVERTER, PHASE DETECTOR, AND D-C AMPLIFIER. These circuits are a radical departure from the conventional systems used for framing the picture in the horizontal direction. Their features are ease of operation, stability and noise immunity.

The sync signal applied to the grid of the sync phase inverter 1/2 of 6SN7 V16A, is partially differentiated by C67 and R84 where equal resistances R85 and R86 provide loads for phase inversion of the applied signal. The two output signals of equal amplitudes and opposite polarities are connected to plate and cathode of separate diodes of 6AL5 (V17) thru C68 and C69. A source of horizontal oscillator output voltage such as that appearing at termii output voltage such as that appearing at terminal five of the horizontal output transformer secondary, is integrated to a sawtooth and applied to the remaining cathode and plate of the 6AL5 V17 Phase Detector.

Resistors R88 and R89 have equal and opposite voltages applied across them when the horizontal oscillator is in phase with the incoming sync signal. If the phase of the pulse changes with respect to the sine wave the top diode will produce more voltage across R88 than the bottom diode produces across R89. Thus, the voltage across the two will be positive or the reverse condition can exist. It is obvious that the output of the phase detector V17 can swing from positive thru zero to negative dependent upon the phase relation of the syncronizing signal and the oscillator. This D-C output is applied to the grid of D-C amplifier V22B 1/2 of 6SN7 and amplified. The amplified D-C voltage is then utilized to correct the horizontal oscillator frequency by altering its bias and bring the oscillator back into the correct phase. Capacitor C107 and resistor R93 connected between plate and grid of V16B serve to provide the proper time constant for "pull in" time.

HORIZONTAL OSCILLATOR AND DISCHARGE:

The function of this stage is to produce a sawtooth voltage for use in the horizontal sweep circuits. One-half of a 6SN7GT V18 is used as a blocking oscillator with C70 R95 R94 and R3A having the greatest frequency determining effect. The oscillator is manually set close to horizontal frame frequency by hold potentiometer R3A where the output of the dc amplifier then takes control of bringing the oscillator back into phase.

The grid of oscillator V18 is directly connected to the discharge triode 2nd half of 6SN7 (V18) which discharges capacitor C71 thru resistor R99. The horizontal peaking circuit consists of C73, horizontal peaking control R5 and resistor R103.

HORIZONTAL OUTPUT, HORIZONTAL DAMPER AND HIGH VOLTAGE SUPPLY:

The operation of these two circuits is so interconnected that it is necessary to discuss them simultaneously. The function of the 6BG6G output tube V19 is to supply current of the proper wave form to the horizontal deflection coil in order to provide horizontal scanning for the picture tube. The function of the horizontal damper V20 is to stop oscillation of certain components at certain times and thus help provide a linear trace. Other functions of these circuits include utilization of energy stored in the horizontal deflection coil to energy stored in the horizontal deflection coil to furnish retrace and picture tube high voltage. The horizontal damper circuit also recovers some of the energy from the yoke kickback and uses it to help supply the plate power requirements of the output tube.

In operation the visible portion of the horizontal trace is approximately 53 microseconds in duration. Although the inductance of the horizontal deflection coil is in the order of 8 millihenries, at the horizontal sweep frequency, the reactance of the coil predominates over its resistance. This is a different case than that encountered in the vertical deflection system and so a different method of operation must be used. Horizontal blanking is approximately 10 microseconds in duration. During this time, the picture tube beam must be returned to the left side of the tube, the trace started and made linear. In order that all this be accomplished within the horizontal blanking time, only 7 microseconds can be allowed for the return trace. In order to obtain such rapid retrace, the horizontal deflection coil, output transformer and associated circuits are designed to resonate at a frequency such that one half cycle of oscillation at this frequency will occur in the 7 microseconds retrace time limit.

During the latter part of the horizontal trace, the output tube conducts very heavily and builds up a strong magnetic field in the deflection coil and output transformer. When the negative pulse from the horizontal tube is applied to the output tube grid V19, its plate current is suddenly cutoff and the magnetic field in the transformer and deflection coil begins to collapse at a rate determined by the resonant frequency of the system. Actually the system is shock excited into oscillation. Since the output tube is cutoff and the voltage generated by the collapsing field in negative on the horizontal damper tube plate so that it is non-conductive, there is essentially no load on the circuit and it oscillates vigorously for one half cycle. If the horizontal damper tube were not present, the circuit would continue to oscillate. This condition, however, is not permitted. One half cycle of oscillation is permitted because at the end of such a time the current in the deflection coil has reached a maximum in the opposite direction to which it was flowing at the end of the trace period. This reversal of the direction of flow of current was the requirement for retrace and it was accomplished in the alloted 7 microseconds.

Now that retrace has been completed, it is necessary to start the next trace. The energy which was placed in the deflection coil by the output tube in the later part of the last trace has not been dissipated. During the one-half cycle of oscillation retrace was accomplished with very little loss in energy. The field in the coil was merely reversed on polarity. So, at this point, a strong field exists in the deflection coil. As mentioned previously, if the coil were not damped, it would continue to oscillate at its natural frequency. To prevent such an oscillation the horizontal damping tube is brought into action. This tube is in a modified damper circuit which is effectively connected across the horizontal deflection coils.

In the oscillating circuit, the current in the deflection coil lags the voltage by approximately 90 degrees and when the current has reached its maximum negative value, the voltage across the coil being 90 degrees ahead, has begun to swing positive. When the voltage on the horizontal damping tube plate becomes positive with respect to the cathode, it begins to conduct heavily. This places such a load across the deflection coil that it cannot oscillate. Instead the field begins to decay at a rate permitted by the load which the damper tube placed on the coil. The circuit constants are such that this decay is linear and at a rate suitable for the visible trace. If no additional energy were fed into the coil the field would fall to zero and the picture tube beam would come to rest in the center of the tube. It is therefore necessary to have the output tube begin to supply power to the deflection coil before the energy in the coil is completely dissipated. Although the currents supplied by the output tube and by the decaying field are curved at the cross over point, together they produce a coil current that is linear. By the time the beam has reached the right side of the picture tube, the output tube is conducting heavily and has built up a strong field in the transformer and coil. At this point, the output tube is again suddenly cutoff and the process repeated.

The 6BG6G (V19) plate voltage is supplied through the 5V4G (V20) which is conducting over the major portion of the trace. Capacitors C110 and C111 are charged during this period and this charge is sufficient to supply the 6BG6G plate when the 5V4G is not conducting. The charge is placed on these capacitors by the receiver b/ supply and the current from the collapse of the field in the horizontal deflection coil. The charge placed on these capacitors by the coil kick-back is therefore in addition to that from the b/ supply and thus the capacitors are charged to a voltage greater than the b/ supply. This permits operation of the 6BG6G at a higher voltage than is obtainable from the receiver power supply and produces an increase in the system efficiency by saving energy that would otherwise have been wasted.

During the trace period, the voltage across C111 varies due to the charging by the horizontal kick-back transformer and discharging through the 6BG6G output tube. This rise and fall of voltage constitutes an a-c "ripple" in the plate supply of the output tube. By shifting the phase of this ripple with respect to the tube place current requirements, slight variations of plate characteristics are obtained. Horizontal linearity coil L17 and C110 constitute a phase shifting network. The horizontal linearity coil L17 is variable by means of an adjustable iron core, and is provided to effect small improvements in horizontal linearity. Counterclockwise rotation of the adjustment screw causes the second quarter of the picture to stretch and the first quarter to crowd in size.

Horizontal peaking control R5, determines the ratio of high peaking and saw-tooth voltage on the grid of the grid of the output tube and thus affects the point on the trace at which the tube conducts. Clockwise rotation of the control increases picture width, crowds the right side of the picture and stretches the left side.

Horizontal size coil L16 is provided to vary the output and hence the picture width by shunting a portion of the horizontal kick-back transformer T4 secondary winding. Clockwise rotation of the size coil adjustment screw increased the picture width and causes the right side of the picture to stretch slightly.

HIGH VOLTAGE POWER SUPPLY:- The picture tube high voltage supply is unusual in that the power is obtained from the energy stored in the deflection inductances during each horizontal scan. When the 6BG6G plate current is cutoff by the incoming signal, a positive pulse appears on the horizontal kick-back transformer T4 primary due to the collapsing field in the deflection coil.

This pulse of voltage is stepped up, rectified by V21 1B3GT, filtered and applied to the second anode of the picture tube. Since the frequency of the supply voltage is high (15,750 cps), relatively little filter capacity C91 is necessary. Since the filter capacity is small, the stored energy is small. The high voltage supply is made less dangerous by current limiting resistor R105.

LOW VOLTAGE POWER SUPPLY:- The low voltage power supply consists of two individual rectifier circuits to provide 150 volts d-c and 400 volts d-c. The 150 volt supply uses a 5Y3GT V27 as a full wave rectifier with C4 as the input capacitor. Choke L2 and C5 complete the filtering. The 150 volt supply is normally connected to the sound portion of the receiver and in addition is switched to the television, FM or AM circuits depending on the position of the bandswitch.

Power for the deflection circuits and audio amplifier is derived from a 5U4G V26 full wave rectifier operating into a condenser input filter C1 and C2 connected in series to sustain the surge voltage. Filter choke L2 and C3 complete the filtering.

AM-FM TUNER:- The AM-FM tuner which is part of this television receiver is a separate sub-chassis. On this sub-chassis are the 6BE6 (V25) AM converter, 6BA6 (V23) FM RF Amplifier, 12AT7 (V24) twin triode FM mixer and oscillator, AM and FM I.F. transformers, AM-FM variable tuning capacitor, FM antenna, RF and oscillator coils and AM oscillator coil. Switching of circuits from AM to FM is accomplished by means of a four wafer band switch which selects TV, FM, AM and Phono circuits.

The AM FM tuner comprises two individual superheterodyne circuits. The conventional superheterodyne circuit is used for AM, and the limiter balanced discriminator circuit used for FM.

FM circuit description-(Band switch in FM position) The incoming FM signal is picked up by the self-contained folded dipole antenna L21 which is connected to the balanced 300 ohm broad band antenna transformer A18, the secondary of which is connected to the grid of V23. The plate circuit comprises RF choke L23 and coupling capacitor C80. The grid circuit of the converter V24A is tuned by inductance L26 and RF section of the variable capacitor. The plate circuit of the converter is tuned by I.F. transformer L28. The grid circuit of transformer L28 is connected to the grid of I.F. tube 6BA6 V11 through the band switch. AVC voltage is applied to the 6BA6 FM R-F amplifier tube V23 through the low side of the secondary transformer L22.

The oscillator section of the 12AT7 twin triode V24B uses a Colpitts circuit operating above the carrier frequency. The oscillator comprises oscillator coil L24, one section of the variable tuning capacitor, fixed capacitor C90, coupling capacitor C85 and grid resistor R118. RF choke L28 in the cathode of the 12AT7 is returned to ground. RF choke C27 and capacitor C87 in the heater center tap of the oscillator maintains stable operation over the FM band.

AM Circuit Description-The broadcast band employs a conventional circuit using a high impedance loop antenna L29 which is coupled to the input grid of the 6BE6 V25. The plate circuit of the converter is tuned by I.F. transformer L31 and connected to the grid of the 6BA6 sound I.F. through the band switch. AVC voltage is applied to the low side of the loop by filter resistor R121 and bypass capacitors C114 and C115.

The oscillator section of the 6BE6 converter uses a conventional Hartley circuit comprising a cut plate section on the variable capacitor, oscillator coil L30, coupling capacitor C88 and grid resistor R119.

ALIGNMENT INSTRUCTIONS

Should any television receiver of the 900 Series require complete realignment, the alignment data on the 920 Series should be used.

PRE ALIGNMENT INSTRUCTIONS—READ CAREFULLY BEFORE ATTEMPTING ALIGNMENT

Remove horizontal oscillator tube (V18) to disable high voltage.

Connect output meter across the voice coil and leave connected until all steps of the broadcast alignment are completed. When using the output meter the volume control should be at maximum and the output of the signal generator should be kept as low as possible.

Use an insulated alignment screwdriver for adjusting.

Waveforms shown may be inverted depending on the number of amplifier stages used in the oscilloscope.

AM IF ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
1	.1 MFD.	High side to Pin #1 of 6BE6 (V25). Low side to chassis.	455KC (Modulated)	AM	1650KC	Across voice coil.	A1, A2, A3, A4	Adjust for maximum output at voice coil.

FM IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIG. GEN. FREQUENCY 900 SERIES	SIG. GEN. FREQUENCY 920 SERIES	BAND SWITCH POS.	CONNECT SCOPE	ADJUST	REMARKS
2	.01 MFD	High side to Pin 7 (grid) of 12AT7. Low side to chassis near tube socket.	21.25MC (1MC sweep) Marker at 21.25MC	20.25MC (1MC Sweep) Marker at 20.25MC	FM	Vertical input to Point (A). Ground to chassis.	A5, A6, A7, A8 A9, A10	Adjust for symmetrical pattern of maximum amplitude with marker at peak. See Fig. 1.
3	.01 MFD	"	"	"	"	Vertical input to Point (A). Ground to chassis.	A11	"
4	.01 MFD	"	"	"	"	Vertical input to Point (D). Ground to chassis.	A12	Adjust for "S" curve with marker at center. Check A11 for maximum straightness of diagonal line. See Fig. 2.

ALTERNATE FM IF ALIGNMENT USING VTVM

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIG. GEN. FREQUENCY 900 SERIES	SIG. GEN. FREQUENCY 920 SERIES	BAND SWITCH POS.	CONNECT VTVM	ADJUST	REMARKS
2	.01 MFD	High side to Pin 7 (grid) of 12AT7. Low side to chassis near tube socket.	21.25MC (Unmodulated)	20.25MC (Unmodulated)	FM	DC probe to Point (C). Common to chassis	A5, A6, A7, A8, A9, A10	Adjust for maximum deflection.
3	.01 MFD	"	"	"	"	DC probe to Point (A). Common to chassis	A11	"
4	.01 MFD	"	"	"	"	DC probe to Point (A). Common to chassis	A12	Adjust for zero. This point must be between a positive and negative peak.

AM & FM RF ALIGNMENT

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	BAND SWITCH POS.	RADIO DIAL SETTING	OUTPUT METER	ADJUST	REMARKS
5		Connect to loop of 2 or 3 turns. Radiate signal into receiver loop.	1600KC (Modulated)	AM	1600KC	Across voice coil	A13	Adjust for maximum output. Be sure dial pointer is set properly as shown in prealignment instructions.
6		"	1500KC (Modulated)	"	Tune for maximum output.	"	A14	Adjust for maximum output
						CONNECT VTVM		
7	2-150Ω carbon res.	Across FM ant. terminals with 150Ω in series with each lead.	108.5MC (Unmodulated)	FM	Tuning cap. fully open.	DC probe to Point (C). Common to chassis	A15	Adjust for maximum deflection.
8	"	"	87.5MC (Unmodulated)	"	Tuning cap. fully closed	"	A16	Adjust for maximum deflection. Repeat Steps 7 & 8 until no further improvement is noted.
9	"	"	95MC (Unmodulated)	"	Tune to signal.	"	A17, A18	Adjust for maximum deflection.

VIDEO IF ALIGNMENT USING VTVM

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIG. GEN. FREQUENCY 900 SERIES	SIG. GEN. FREQUENCY 920 SERIES	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
10	Direct	High side to either side of R129. Low side to chassis.	24.2MC	23.2MC	8	Across 6800Ω resistor in grid of 6AC7, Point (E).	A19	Adjust for maximum deflection.
11	Direct	"	22.6MC	21.6MC	8	"	A20	"
12	Direct	"	25.6MC	24.6MC	8	"	A21	"
13	Direct	"	26.6MC	25.6MC	8	"	A22	"
14	Direct	"	22.8MC	21.8MC	8	"	A23	"
15	Direct	"	21.25MC	20.25MC	8	"	A24	Adjust for minimum deflection. Use freq. identical to that used for FM IF Alignment.

VIDEO IF ALIGNMENT USING FM SIGNAL GENERATOR AND OSCILLOSCOPE

If signal generator having 10MC FM sweep and oscilloscope are available, the visual check in Step 16 should be performed. Otherwise continue with Step 31. Do not attempt RF Alignment without sweep signal generator and oscilloscope.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIG. GEN. FREQUENCY 900 SERIES	SIG. GEN. FREQUENCY 920 SERIES	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
16	5000MMF	High side to Pin #1 of 1st Sound IF Amp. (V11). Low side to chassis	24MC (6MC sweep) For markers see Fig. 3.	23MC (6MC sweep) For markers see Fig. 3.	8	Vertical input to Point (E). Ground to chassis.	A19, A20 A21, A22 A23	Adjust for pattern as shown in Fig. 3. The video carrier should set half-way up the slope as shown. Only slight adjustment of any slug should be necessary.

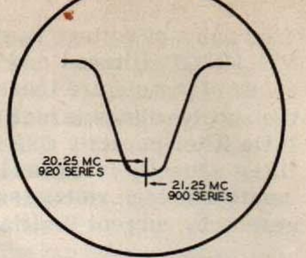


FIG. 1

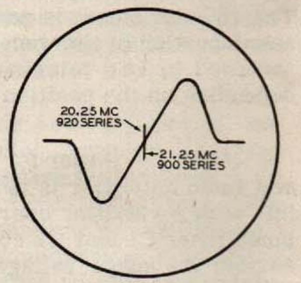


FIG. 2

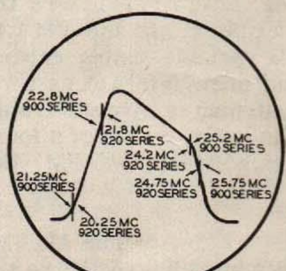


FIG. 3

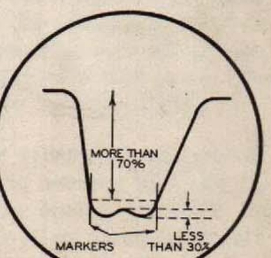


FIG. 4

TV RF ALIGNMENT

Do not attempt alignment of the tuner unless it is known to be out of alignment and all TV IF (Sound & Video) adjustments have been made. The signal generator lead should be terminated with a carbon resistor equal to the output impedance of the signal generator (usually 50 ohms). Connect a 100 ohm carbon resistor in series with each lead to the antenna terminals.

TV RF ALIGNMENT (RCA TUNER)

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
17	100Ω in series with each lead.	TV antenna terminals.	177MC 10MC sweep	175.25 179.75 Connect loosely to either antenna terminal.	7	Vertical input to Point ◇F in series with 10KΩ. (Accessible through hole in side of chassis.) Ground to chassis.	A25, A26 A27, A28	Waveform should be approximately as shown in Fig. 4. Markers should be at more than 70% of peak amplitude and dip in center should not exceed 30%.
18	"	"	183MC 10MC sweep	181.25 185.75	8	"	"	Check for markers at greater than 70%, and not more than 30% dip in center. Make slight readjustments of A25, A26, A27 & A28 if necessary.
19	"	"	189MC 10MC sweep	187.25 191.75	9	"	"	"
20	"	"	195MC 10MC sweep	193.25 197.75	10	"	"	"
21	"	"	201MC 10MC sweep	199.25 203.75	11	"	"	"
22	"	"	207MC 10MC sweep	205.25 209.75	12	"	"	"
23	"	"	213MC 10MC sweep	211.25 215.75	13	"	"	"
24								Recheck Steps 17 to 23 and make slight adjustments if necessary.
25	100Ω in series with each side	TV antenna terminals.	85MC 10MC sweep	83.25MC 87.75MC	6	Vertical input to Point ◇F in series with 10KΩ. (Accessible through hole in side of chassis.) Ground to chassis.	A29, A30 A31, A32	Waveform should be approximately as shown in Fig. 4. Markers should be at more than 70% of peak amplitude and dip in center should not exceed 30%.
26	"	"	79MC 10MC sweep	77.25MC 81.75MC	5	"	"	Check for markers at generator than 70%, and not more than 30% dip in center. Make slight readjustments of A29, A30, A31 and A32 if necessary.
27	"	"	69MC 10MC sweep	67.25MC 71.75MC	4	"	"	"
28	"	"	63MC 10MC sweep	61.25MC 65.75MC	3	"	"	"
29	"	"	57MC 10MC sweep	55.25MC 59.75MC	2	"	"	"
30								Recheck Steps 25 to 29 and make slight adjustments if necessary.

OSCILLATOR ALIGNMENT

Set fine tuning control to a position approximately 140° from its full counter-clockwise position. This aligns the holes in the drive disc with the adjustment screws on the oscillator switch wafer. Do not change this setting during entire oscillator alignment.

All oscillator adjustment points except A33, A34, A41 and A42 are found directly behind the large hole in the bandswitch dial string drum. Insert screwdriver through this hole to make adjustments.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
31	100Ω in series with each lead	TV antenna terminals	215.75MC	13	DC probe to Point ◇. Common to chassis.	A33 or A34	Adjust for maximum deflection. Signal generator frequency must be set very accurately.
32	"	"	209.75MC	12	"	A35	"
33	"	"	203.75MC	11	"	A36	"
34	"	"	197.75MC	10	"	A37	"
35	"	"	191.75MC	9	"	A38	"
36	"	"	185.75MC	8	"	A39	"
37	"	"	179.75MC	7	"	A40	"
38	"	"	87.75MC	6	"	A41 or A42	"
39	"	"	81.75MC	5	"	A43	"
40	"	"	71.75MC	4	"	A44	"
41	"	"	65.75MC	3	"	A45	"
42	"	"	59.75MC	2	"	A46	"

WAVE TRAP ADJUSTMENT

Wave traps A47 and A48 are used for specific types of interference, and their alignment will depend on the type interference encountered.

With the receiver tuned to the channel being interfered with, A47 and A48 should be adjusted for minimum interference. The two slugs should be set in approximately the same position.

TV OSC. ALIGNMENT (TARZIAN TUNER)

Set fine tuning control at the center of its range. The oscillator adjustments in this tuner are independent so only those channels which are out of alignment need be adjusted. The RF and mixer lines are very stable and normally should never require adjustment.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
17	2-100Ω carbon res. (See above)	Antenna terminals	215.75MC (Unmodulated)	13	DC probe to Point ◈. Common to chassis.	A49	Expand or compress coil for maximum deflection. Signal generator freq. must be set very accurately.
18	"	"	209.75MC	12	"	A50	"
19	"	"	203.75MC	11	"	A51	"
20	"	"	197.75MC	10	"	A52	"
21	"	"	191.75MC	9	"	A53	"
22	"	"	185.75MC	8	"	A54	"
23	"	"	179.75MC	7	"	A55	"
24	"	"	87.75MC	6	"	A56	Adjust for maximum deflection.
25	"	"	81.75 MC	5	"	A57	"
26	"	"	71.75 MC	4	"	A58	"
27	"	"	65.75MC	3	"	A59	"
28	"	"	59.75MC	2	"	A60	"

TV RF ALIGNMENT (GEN. INST. TUNER)

Set fine tuning control to the center of its range during adjustments. Short the low end of R146 to chassis.
Use the synchronized sweep voltage from the signal generator for horizontal deflection.

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	MARKER GENERATOR FREQUENCY	CHANNEL	CONNECT SCOPE	ADJUST	REMARKS
17	2-100Ω carbon res. (see above)	Antenna terminals.	213MC (10MC sweep)	211.25MC & 215.75MC	13	Vert. Amp. to Point ◈. Ground to chassis.	A61, A62 A63, A64	Adjust for response approx. as shown in Fig. 4 with markers more than 70% of peak amplitude. Keep the RF and mixer trimmer pairs in approx. the same relative position.
18	"	"	177MC (10MC sweep)	175.25MC & 179.75MC	7	"	A65, A66	Adjust rings for wave form per Fig. 4.
19	"	"	183MC (10MC sweep)	181.25MC & 185.75MC	8	"		Check response on all channels. Slight adjustments of A61, A62, A63, A64, A65 or A66 may be required to obtain optimum response for all channels.
			189MC (10MC sweep)	187.25MC & 191.75MC	9			
			195MC (10MC sweep)	193.25MC & 197.75MC	10			
			201MC (10MC sweep)	199.25MC & 203.75MC	11			
			207MC (10MC sweep)	205.25MC & 209.75MC	12			
20	"	"	85MC (10MC sweep)	83.25MC 87.75MC	6	"	A67, A68 A69, A70	Adjust for response approx. as shown in Fig. 4.
21	"	"	79MC (10MC sweep)	77.25MC & 81.75MC	5	"		Check response on all channels. Slight adjustments of A67, A68, A69 or A70 may be required to obtain optimum response for all channels.
			69MC (10MC sweep)	67.25MC & 71.75MC	4			
			63MC (10MC sweep)	61.25MC & 65.75MC	3			
			57MC (10MC sweep)	55.25MC & 59.75MC	2			

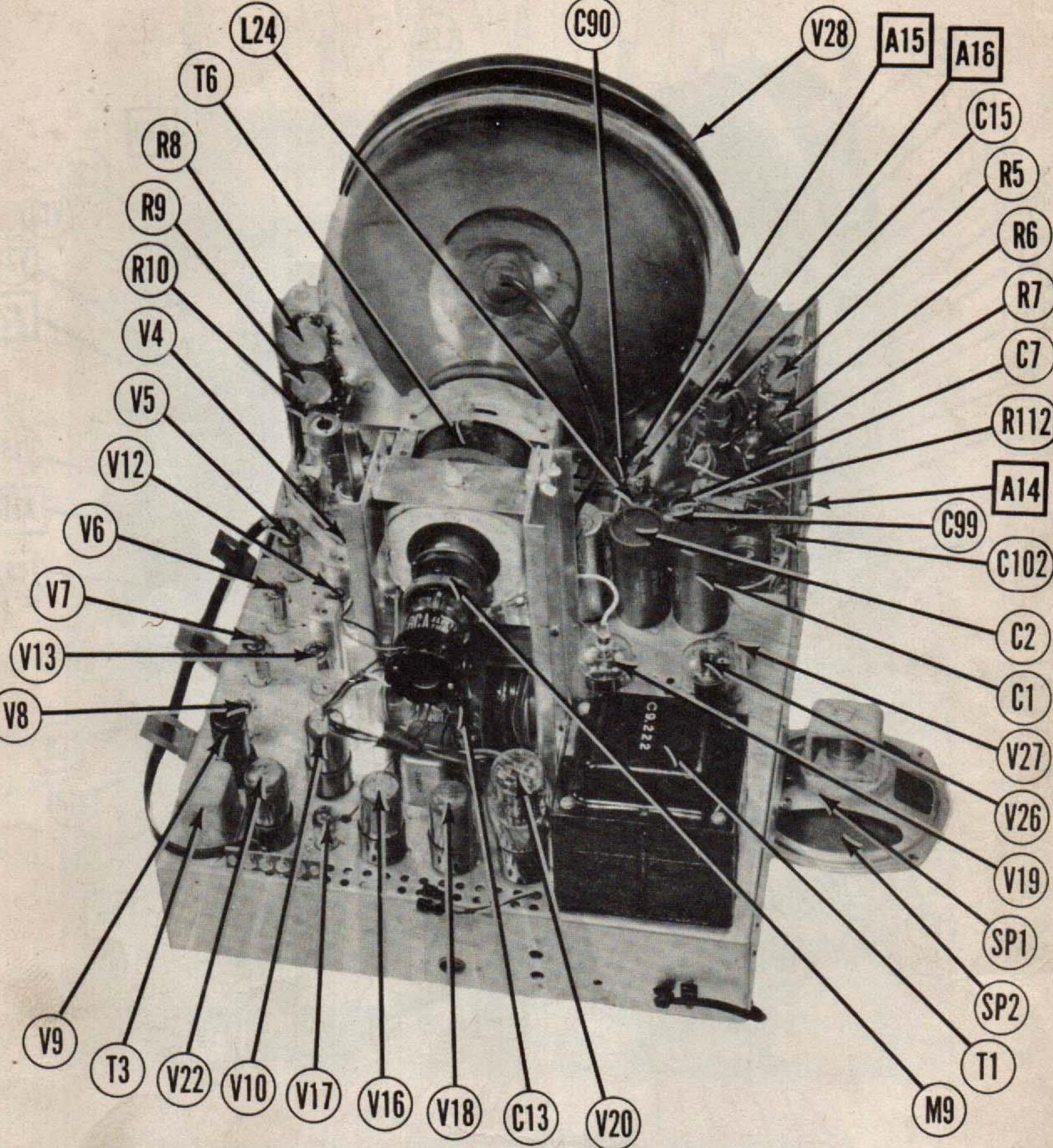
TV OSC. ALIGNMENT (GEN. INST. TUNER)

	DUMMY ANTENNA	SIGNAL GENERATOR COUPLING	SIGNAL GENERATOR FREQUENCY	CHANNEL	CONNECT VTVM	ADJUST	REMARKS
22	2-100Ω carbon res.	Antenna terminals.	215.75MC	13	DC probe to Point ◈. Common to chassis.	A71	Adjust for maximum deflection.
23	"	" "	87.75MC	6	"	A72	"
24	"	" "					Check to see that all other channels are received well within limits of fine tuning control. If not, some compromise may be made using A71 for channels 7 through 13 and A72 for channels 2 through 6.

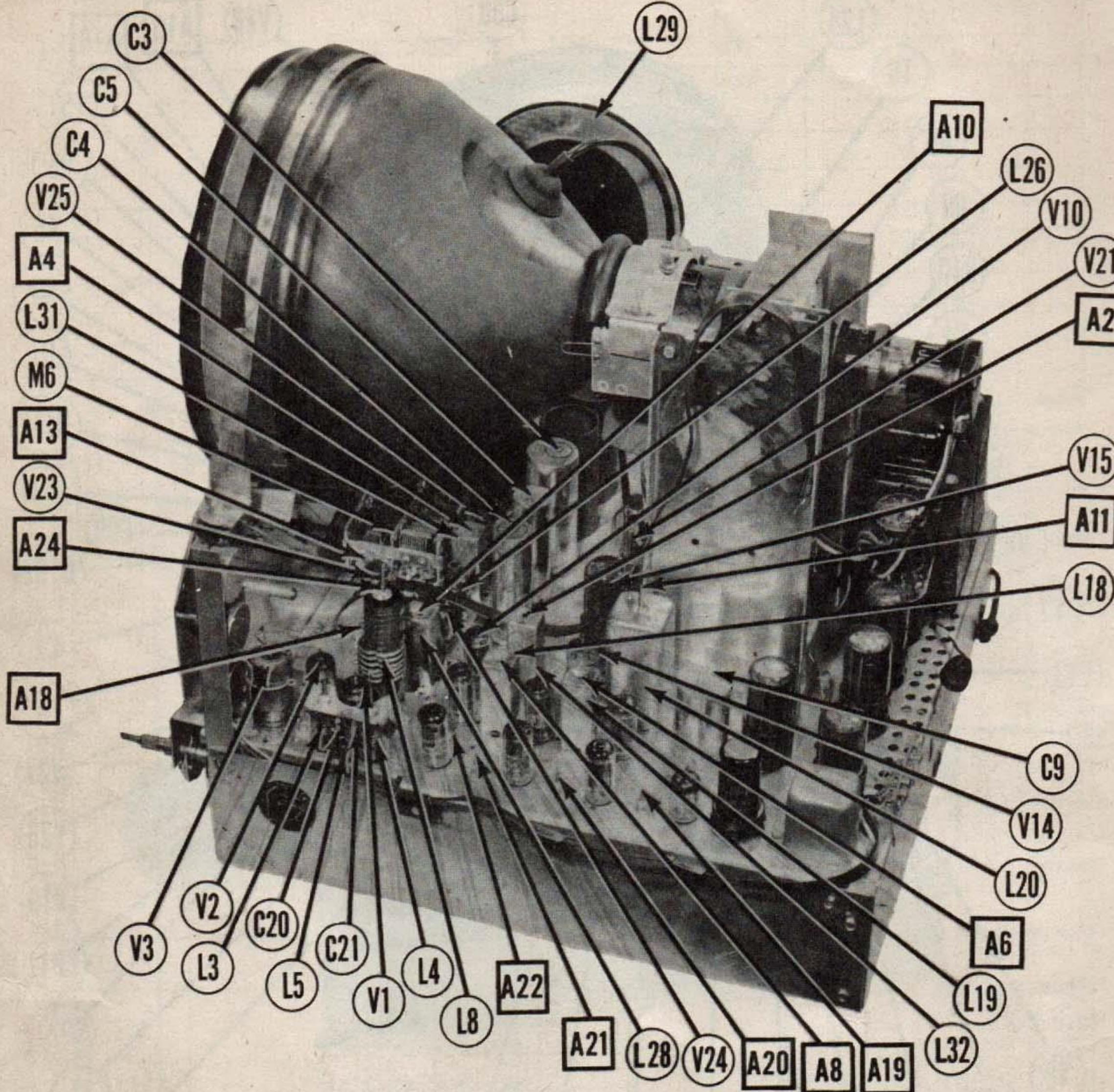
WAVE TRAP ADJUSTMENT

Wave traps A47 and A48 are used for specific types of interference, and their alignment will depend on the type interference encountered.

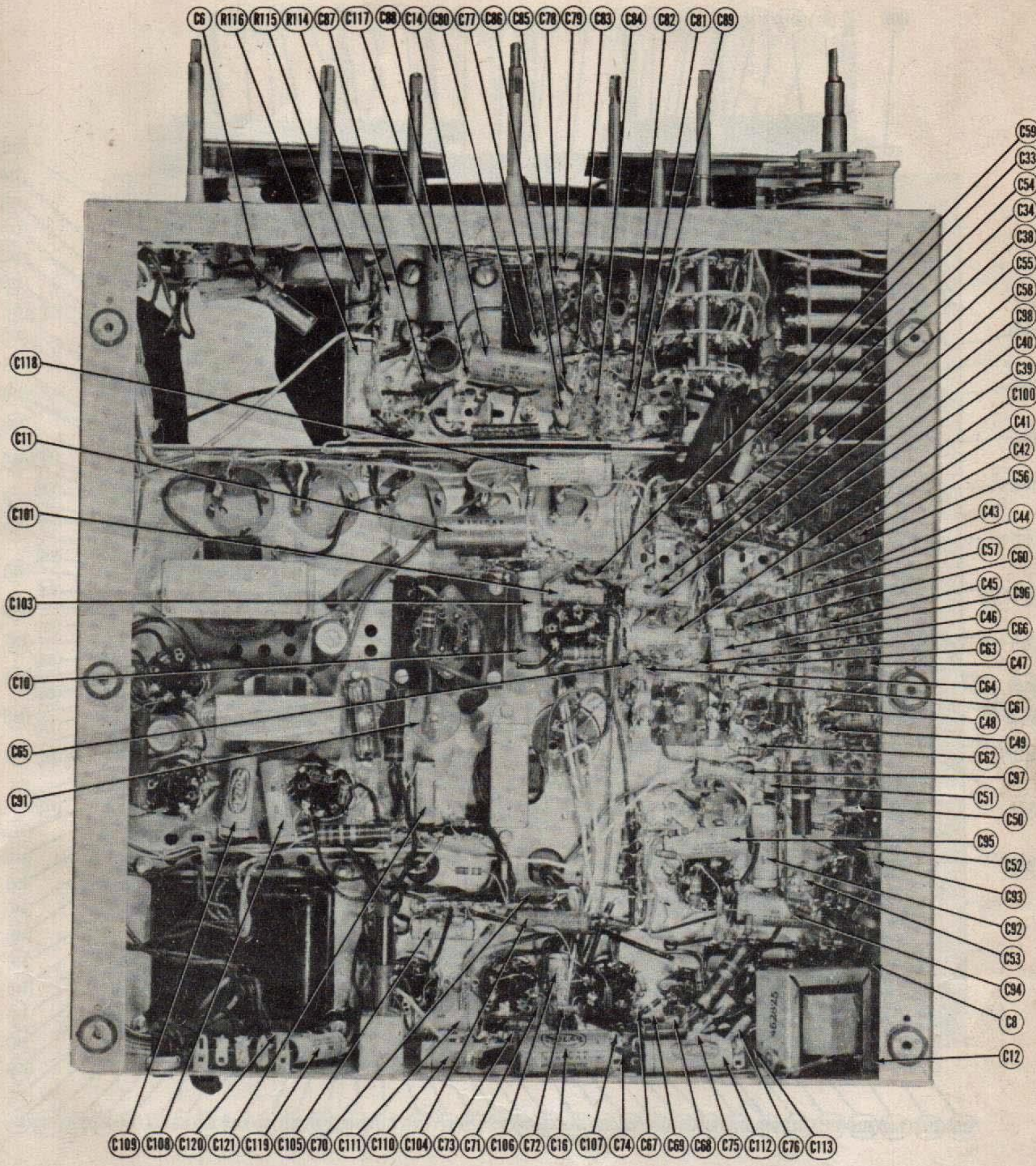
With the receiver tuned to the channel being interfered with, A47 and A48 should be adjusted for minimum interference. The two slugs should be set in approximately the same position.



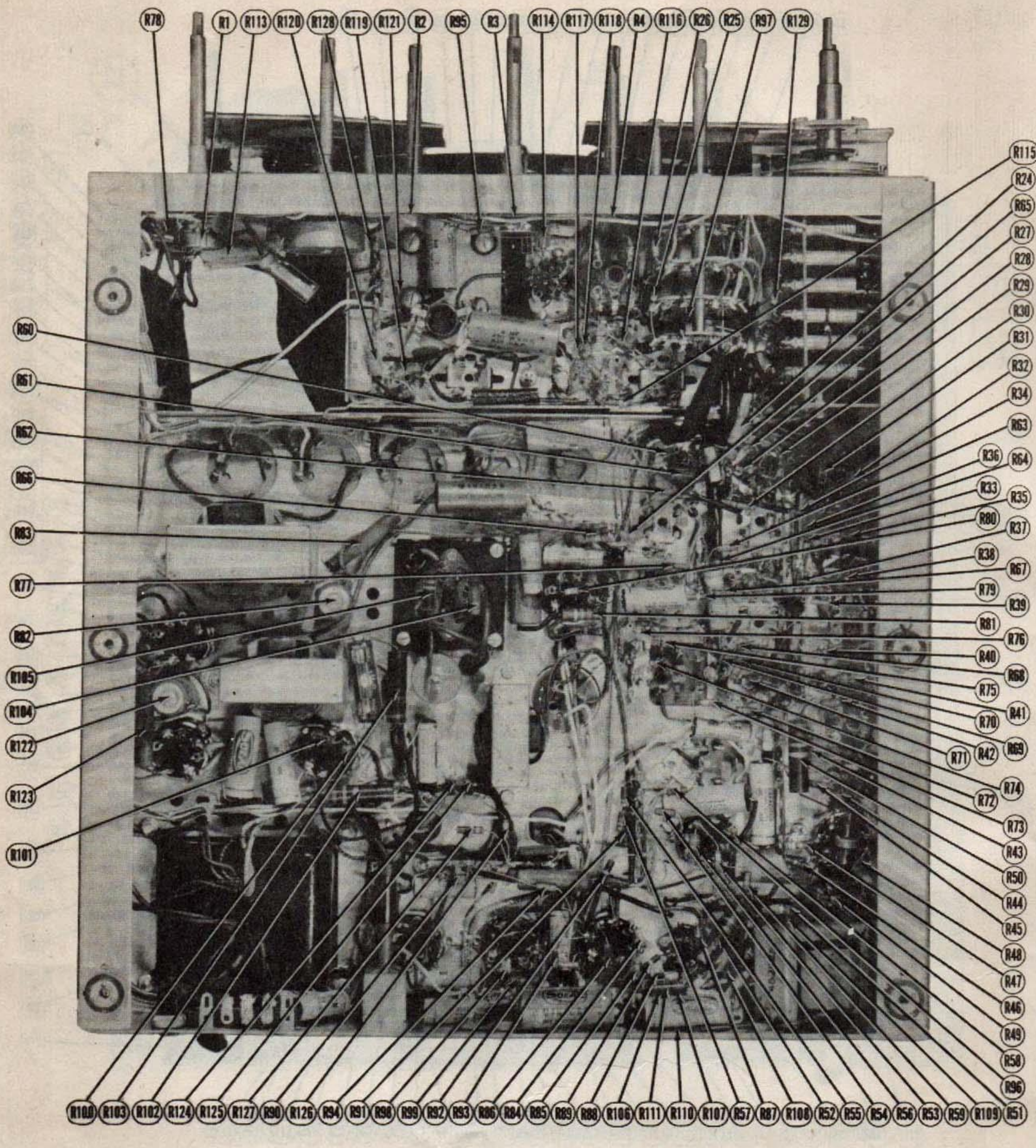
CHASSIS TOP VIEW-LEFT SIDE



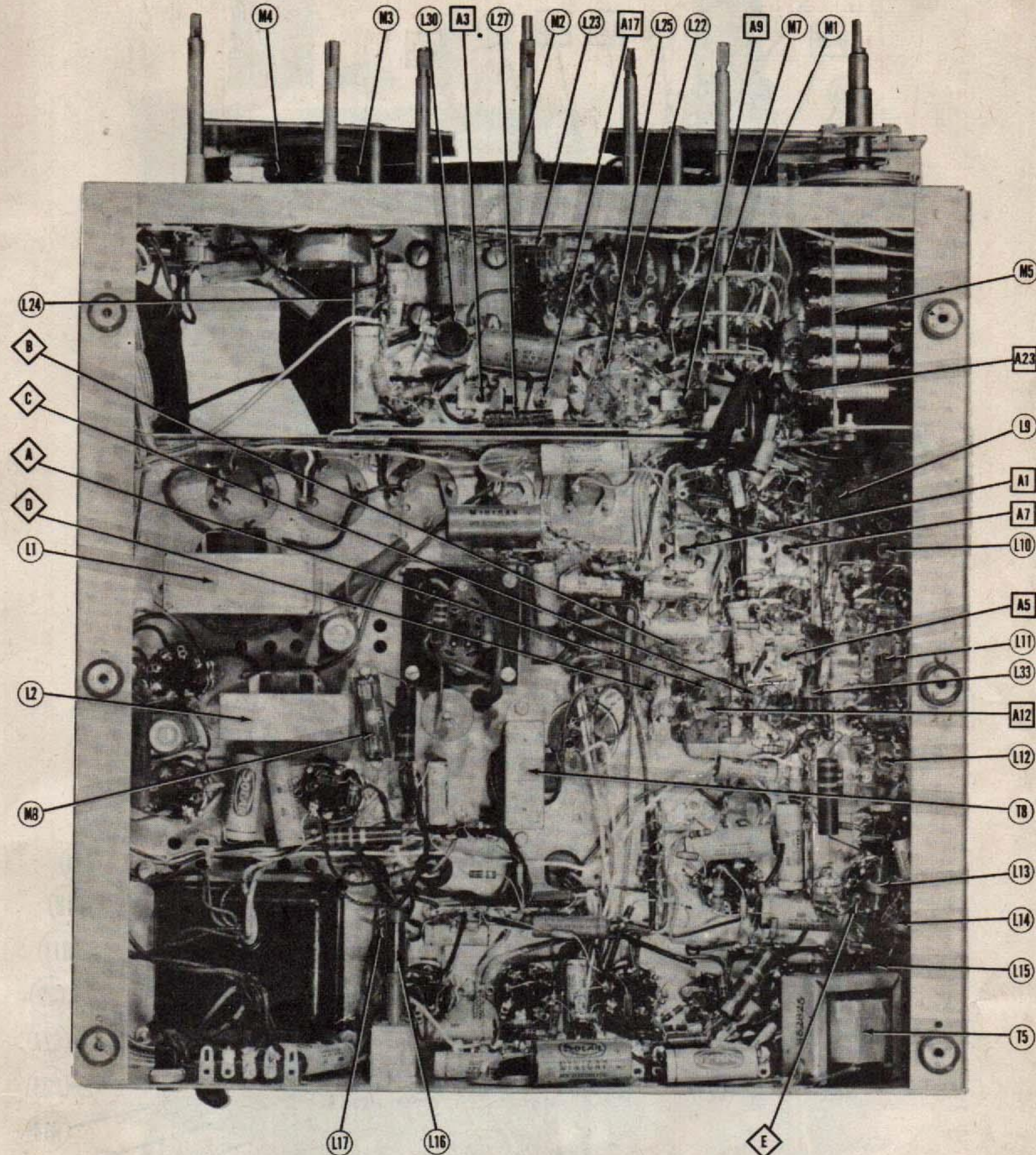
CHASSIS TOP VIEW-RIGHT SIDE



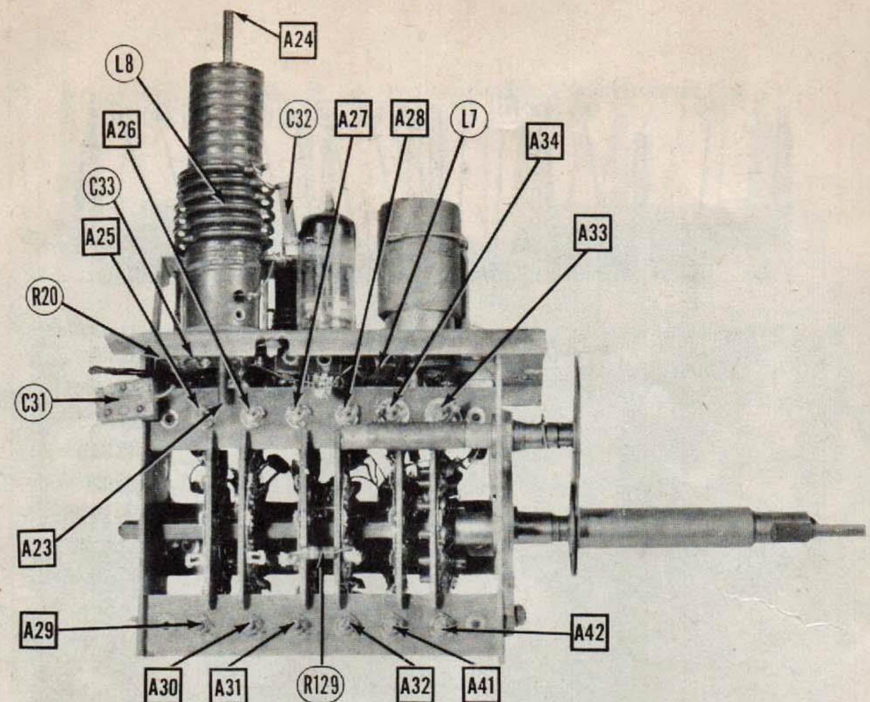
CHASSIS BOTTOM VIEW–CAPACITOR IDENTIFICATION



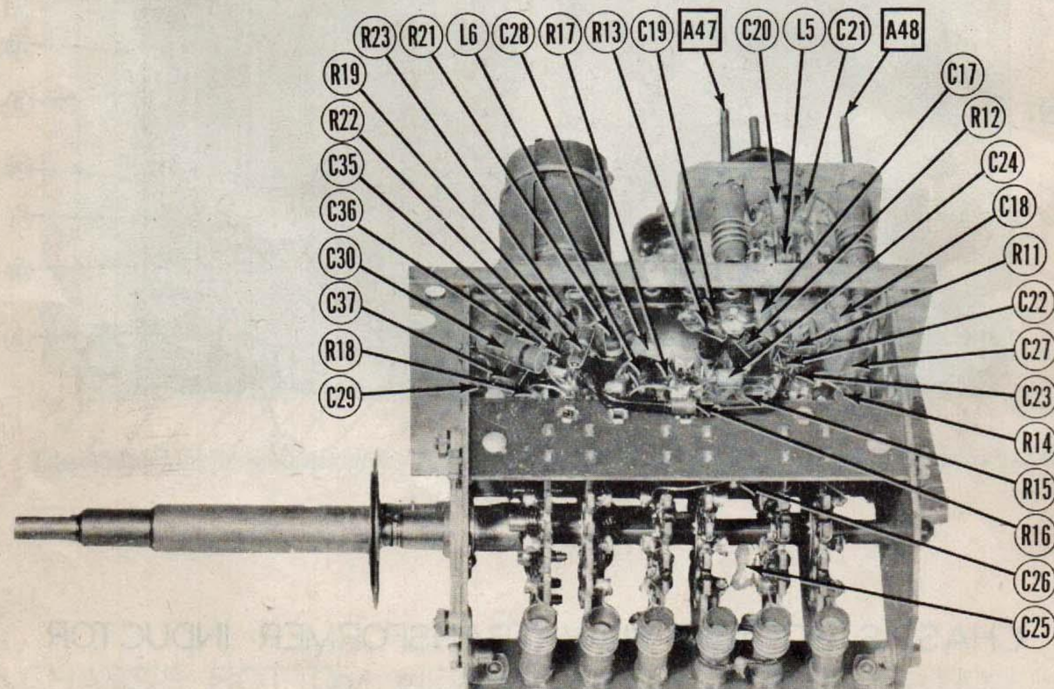
CHASSIS BOTTOM VIEW—RESISTOR IDENTIFICATION



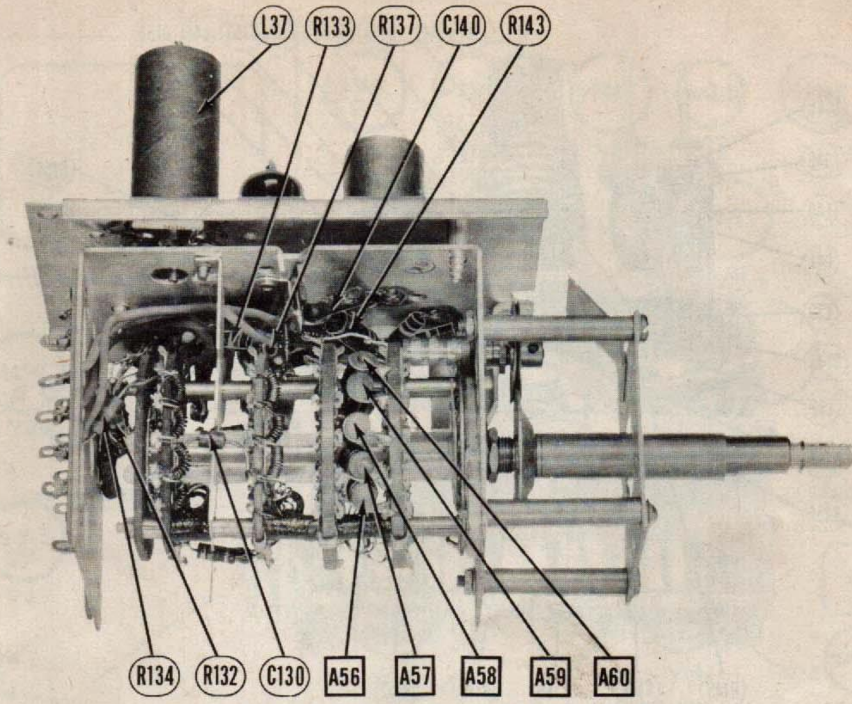
CHASSIS BOTTOM VIEW—TRANSFORMER INDUCTOR AND ALIGNMENT IDENTIFICATION



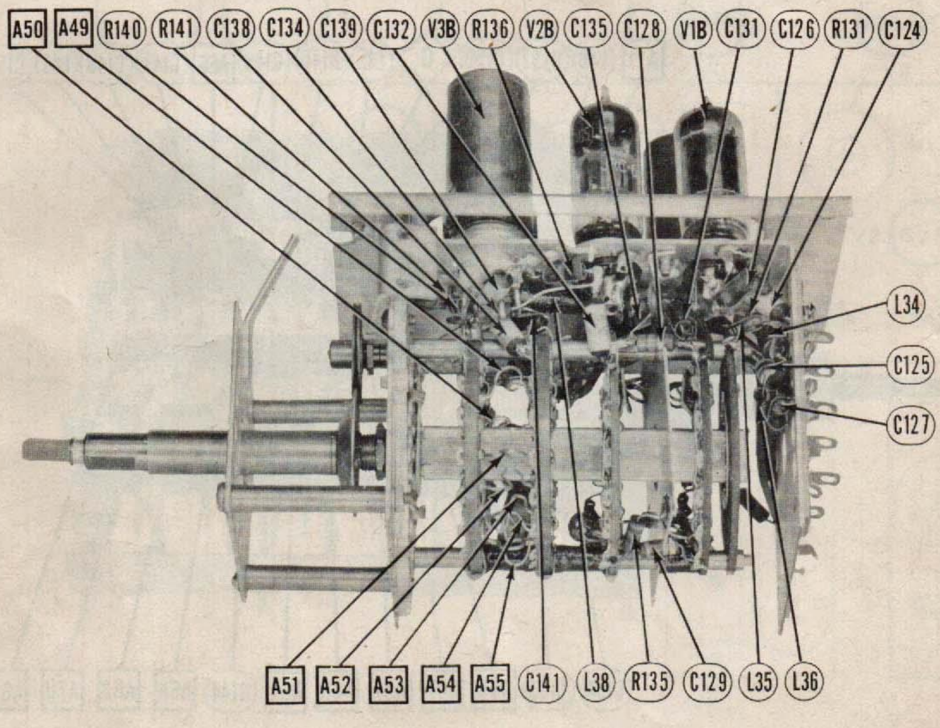
RCA TUNER-LEFT SIDE



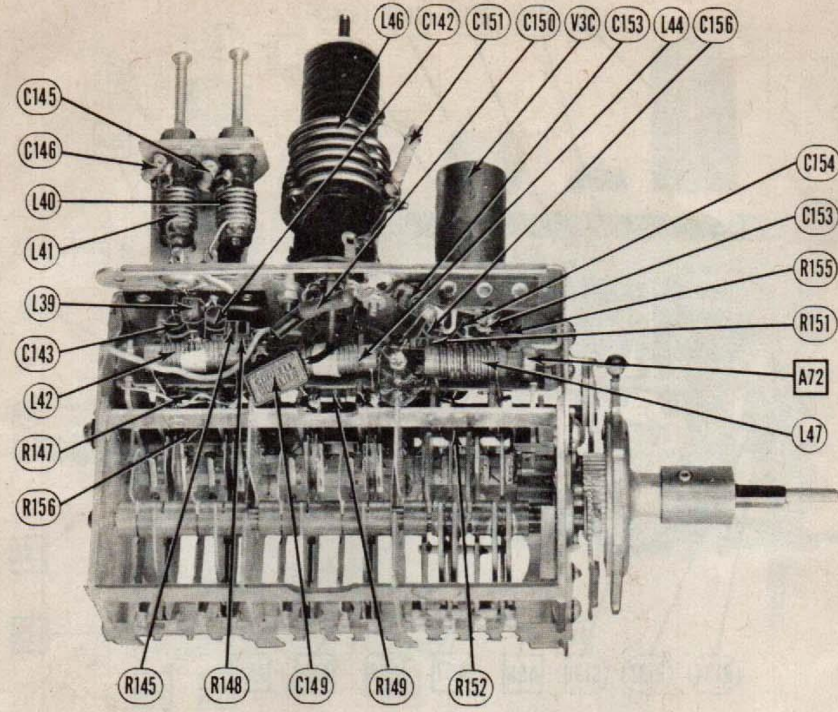
RCA TUNER-RIGHT SIDE



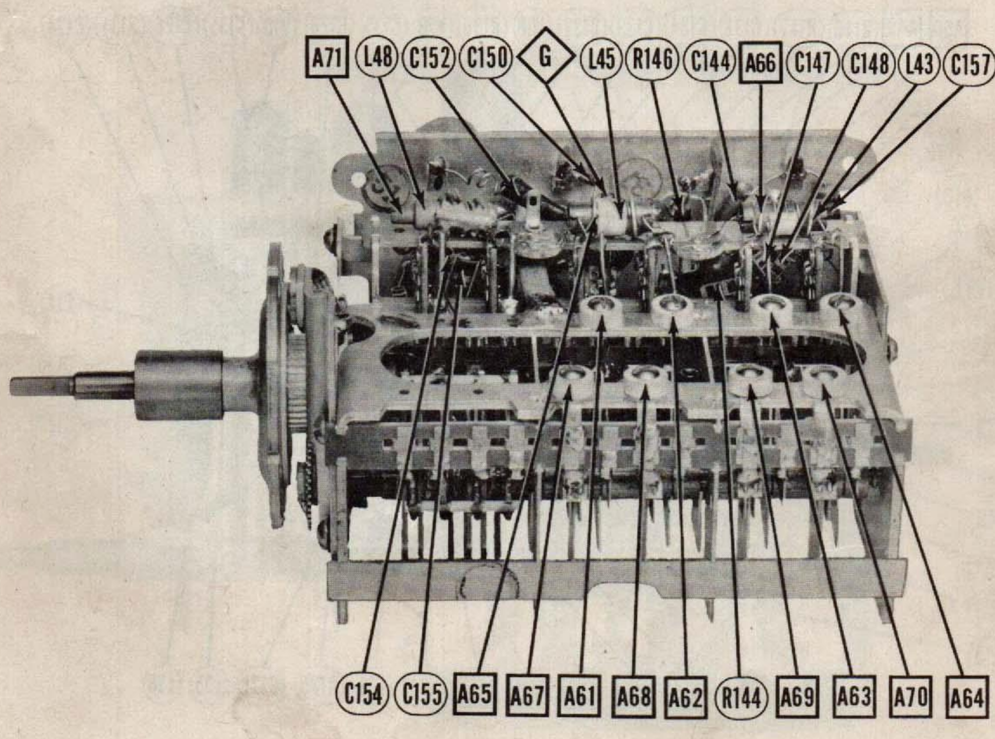
SARKES TARZIAN TUNER-LEFT SIDE



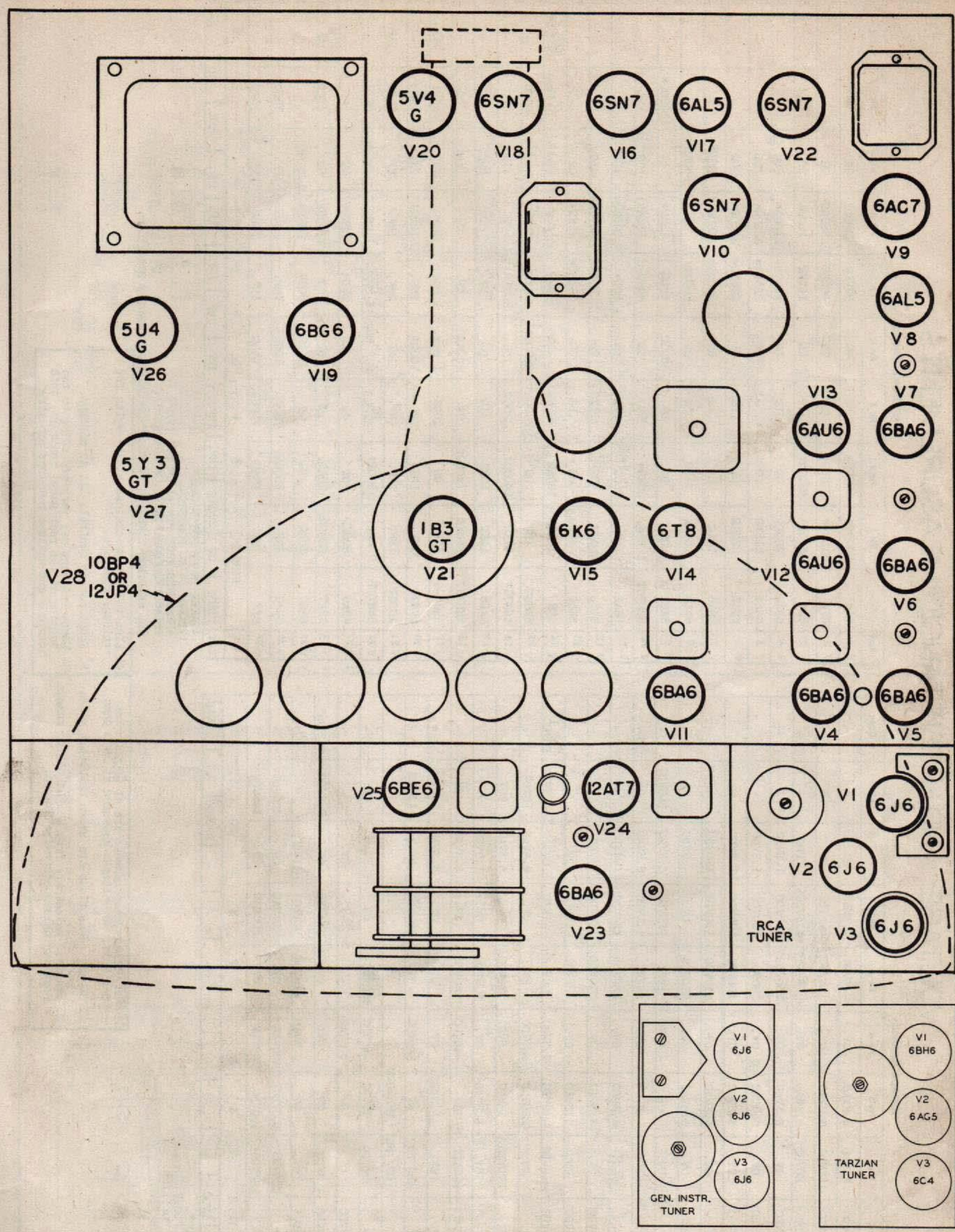
SARKES TARZIAN TUNER-RIGHT SIDE



GEN. INSTR. TUNER-LEFT SIDE



GEN. INSTR. TUNER-RIGHT SIDE



TUBE PLACEMENT CHART

VOLTAGE AND RESISTANCE MEASUREMENTS

VOLTAGE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Cap
V1	6J6	60VDC	60VDC	6.3VAC	OV.	-.3VDC	-.3VDC	OV.	-	-
V2	6J6	105VDC	105VDC	6.3VAC	OV.	-3VDC	-3VDC	OV.	-	-
V3	6J6	60VDC	60VDC	6.3VAC	OV.	-3.5VDC§	-3.5VDC§	.2VDC	-	-
V4	6BA6	-1.2VDC	OV.	6.3VAC	OV.	100VDC	100VDC	1.2VDC	-	-
V5	6BA6	-.2VDC	OV.	6.3VAC	OV.	100VDC	100VDC	1.2VDC	-	-
V6	6BA6	-.2VDC	OV.	6.3VAC	OV.	105VDC	105VDC	1.2VDC	-	-
V7	6BA6	OV.	OV.	6.3VAC	OV.	110VDC	110VDC	110VDC	-	-
V8	6AL5	1VDC	OV.	6.3VAC	OV.	1.2VDC	OV.	-.5VDC	-	-
V9	6AC7	OV.	OV.	OV.	-.4VDC	2VDC	120VDC	6.3VAC	155VDC	-
V10	6SN7GT	-.3VDC	60VDC	OV.	OV.	8VDC	1.1VDC	6.3VAC	OV.	-
V11	6BA6	OV.	OV.	6.3VAC	OV.	130VDC	120VDC	1.4VDC	-	-
V12	6AU6	-.1VDC	OV.	6.3VAC	OV.	110VDC	110VDC	.7VDC	-	-
V13	6AU6	-.5VDC	OV.	6.3VAC	OV.	22VDC	41VDC	OV.	-	-
V14	6T8	-.8VDC	-.8VDC	-.2VDC	6.3VAC	OV.	-1VDC	OV.	-.7VDC	PIN #9 60VDC
V15	6K6GT	OV.	OV.	230VDC	250VDC	OV.	OV.	6.3VAC	16VDC	-
V16	6SN7GT	OV.	370VDC	14VDC	-.5VDC	10VDC	OV.	6.3VAC	OV.	-
V17	6AL5	OV.	OV.	6.3VAC	OV.	1.9VDC	OV.	-1.9VDC	-	-
V18	6SN7GT	-40VDC	200VDC	OV.	-40VDC	140VDC	OV.	6.3VAC	OV.	-
V19	6BG6-G	OV.	OV.	11.5VDC	OV.	OV.	OV.	6.3VAC	260VDC	**
V20	5V4G	OV.	450VDC	OV.	380VDC	OV.	380VDC	OV.	450VDC	-
V21	1B3GT		DO NOT	MEASURE						
V22	6SN7GT	OV.	370VDC	OV. 19VDC	-40VDC	50VDC 180VDC	OV.	6.3VAC	OV.	-
‡ V23	6BA6	-.6VDC	OV.	OV.	6.3VAC	-	-	OV.	-	-
‡ V24	12AT7	185VDC	-.3VDC§	OV.	OV.	OV.	185VDC	OV.	2.6VDC	PIN 9 6.3VAC
†† V25	6BE6	-4VDC§	OV.	OV.	6.3VAC	215VDC	90VDC	-.1VDC	-	-
V26	5U4G	OV.	400VDC	400VDC	400VAC	OV.	400VAC	OV.	400VDC	-
V27	5Y3	OV.	145VDC	400VDC	220VAC	OV.	220VAC	OV.	145VDC	-

Item	Tube	PINS 1	2	3	4	5	6	7	8	9	10	11	12
V28	10BP4	OV.	1VDC	-	-	-	-	-	-	-	270VDC	OV.	6.3VAC

**DO NOT MEASURE.
‡TAKEN IN FM POSITION.
††TAKEN IN BC POSITION.
§MEASURED WITH VTVM.

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7	Pin 8	Cap
V1	6J6	5000Ω*	5000Ω*	.1Ω	0Ω	7500Ω	7500Ω	0Ω	-	-
V2	6J6	2150Ω*	2150Ω*	.1Ω	0Ω	850KΩ	850KΩ	0Ω	-	-
V3	6J6	6500Ω*	6500Ω*	.1Ω	0Ω	100KΩ	100KΩ	50Ω	-	-
V4	6BA6	220KΩ	0Ω	.1Ω	0Ω	2400Ω*	2400Ω*	80Ω	-	-
V5	6BA6	215KΩ	0Ω	.1Ω	0Ω	2250Ω*	2250Ω*	75Ω	-	-
V6	6BA6	220KΩ	0Ω	.1Ω	0Ω	2350Ω*	2350Ω*	80Ω	-	-
V7	6BA6	10KΩ	0Ω	.1Ω	0Ω	2350Ω*	2350Ω*	150Ω	-	-
V8	6AL5	100KΩ	.5Ω	.1Ω	0Ω	6800Ω	0Ω	600KΩ	-	-
V9	6AC7	0Ω	0Ω	0Ω	6800Ω	400Ω	15KΩ*	.1Ω	5000Ω*	-
V10	6SN7GT	1 Meg.	20KΩ*	.0Ω	0Ω	40KΩ*	150KΩ	.1Ω	0Ω	-
V11	6BA6	0Ω	0Ω	.1Ω	0Ω	80Ω*	2200Ω*	100Ω	-	-
V12	6AU6	450KΩ	0Ω	.1Ω	0Ω	2200Ω*	2200Ω*	65Ω	-	-
V13	6AU6	45KΩ	0Ω	.1Ω	0Ω	50KΩ*	45KΩ*	0Ω	-	-
V14	6T8	100KΩ	100KΩ	200KΩ	.1Ω	0Ω	1 Meg.	0Ω	10 Meg.	PIN 9 220KΩ*
V15	6K6GT	INF.	0Ω	2800Ω†	2300Ω†	470KΩ	INF.	.1Ω	550Ω	-
V16	6SN7GT	47KΩ	2400Ω†	2200Ω	INF.	200KΩ†	0Ω	.1Ω	0Ω	-
V17	6AL5	10KΩ	10KΩ	.1Ω	0Ω	INF.	0Ω	INF.	-	-
V18	6SN7GT	240KΩ	120KΩ†	0Ω	240KΩ	INF.	0Ω	.1Ω	0Ω	-
V19	6BG6-G	INF.	0Ω	100Ω	1 Meg.	1 Meg.	INF.	.1Ω	11KΩ†	INF.
V20	5V4G	INF.	INF.	INF.	100Ω†	INF.	100Ω†	INF.	INF.	-
V21	1B3GT	INF.	INF.	INF.	INF.	INF.	INF.	INF.	INF.	INF.
V22	6SN7GT	7 Meg.	1500Ω†	0Ω 5000Ω	2.2 Meg.	1 Meg. 6 Meg.:†	0Ω	.1Ω	0Ω	-
‡ V23	6BA6	500KΩ	0Ω	0Ω	.1Ω	65Ω*	10KΩ*	0Ω	-	-
‡ V24	12AT7	2200Ω*	20KΩ	1Ω	0Ω	0Ω	2200Ω*	0Ω	470Ω	PIN 9 .1Ω
†† V25	6BE6	20KΩ	.5Ω	0Ω	.1Ω	80Ω*	20KΩ*	1.5 Meg.	-	-
V26	5U4G	INF.	750Ω	750Ω	165Ω	INF.	165Ω	INF.	750Ω	-
V27	5Y3	INF.	18KΩ	750Ω	155Ω	INF.	155Ω	INF.	18KΩ	-

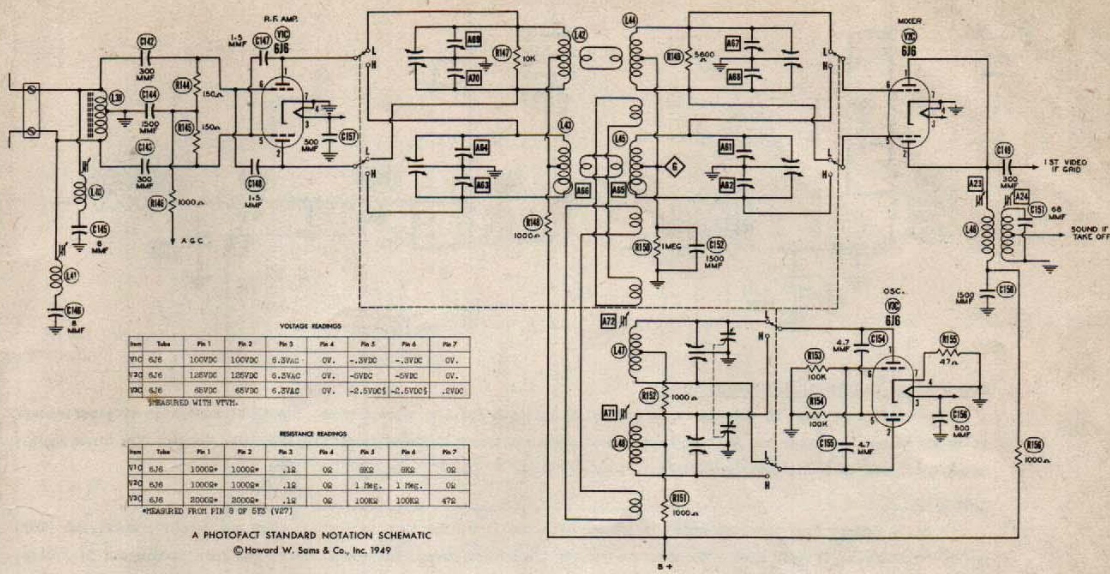
Item	Tube	PINS 1	2	3	4	5	6	7	8	9	10	11	12
V28	10BP4	0Ω	200KΩ	INF.	INF.	INF.	INF.	INF.	INF.	INF.	35KΩ	0Ω	.1Ω

‡TAKEN IN FM POSITION.
††TAKEN IN BC POSITION.
*MEASURED FROM PIN #1 OF 5Y3 (V27).
†MEASURED FROM PIN #8 OF 5U4 (V26).

ALL READINGS TAKEN IN TV POSITION UNLESS OTHERWISE STATED.

1. DC Voltage measurements are at 20,000 ohms per volt; AC Voltages measured at 1000 ohms.
2. Socket connections are shown as bottom views.
3. Measured values are from socket pin to common negative unless otherwise stated.
4. Line voltage maintained at 117 volts for voltage readings.
5. Front panels controls set at maximum.
6. Where readings may vary according to the setting of the rear panel controls, both minimum and maximum readings are given.

GENERAL INSTRUMENT TUNER



VOLTAGE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V1C	6J6	100VDC	100VDC	6.3VAC	OV.	-.3VDC	-.3VDC	OV.
V2C	6J6	125VDC	125VDC	6.3VAC	OV.	-5VDC	-5VDC	OV.
V3C	6J6	65VDC	65VDC	6.3VAC	OV.	-2.5VDC§	-2.5VDC§	.2VDC

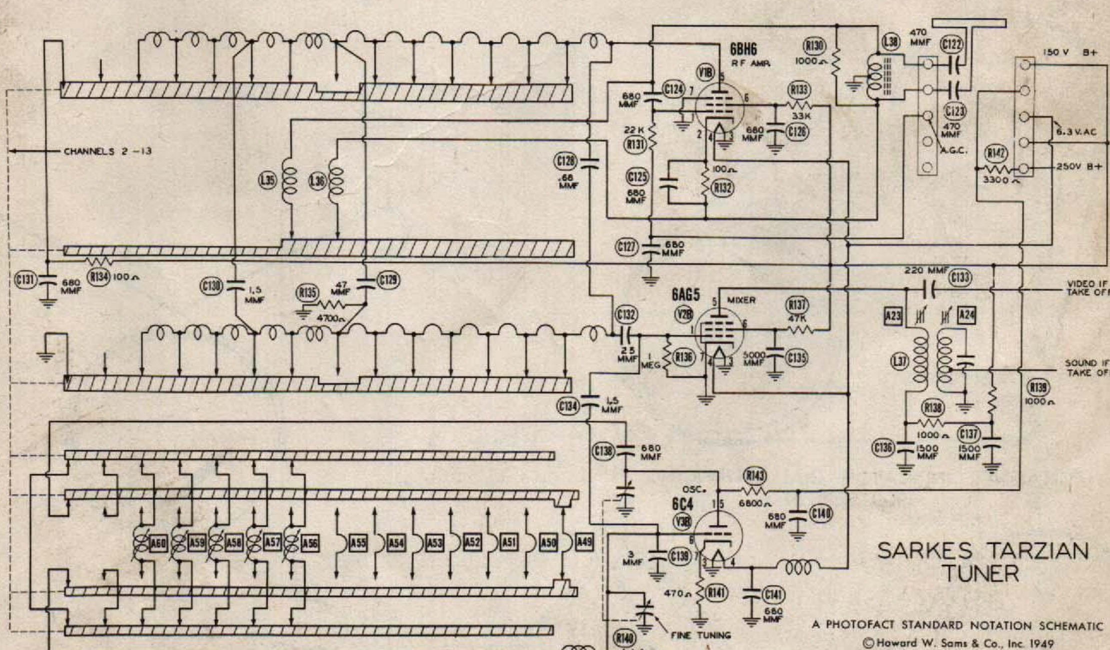
§MEASURED WITH VTVM.

RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V1C	6J6	1000Ω*	1000Ω*	.1Ω	OΩ	8KΩ	8KΩ	OΩ
V2C	6J6	1000Ω*	1000Ω*	.1Ω	OΩ	1 Meg.	1 Meg.	OΩ
V3C	6J6	2000Ω*	2000Ω*	.1Ω	OΩ	100KΩ	100KΩ	47Ω

*MEASURED FROM PIN 8 OF 5Y3 (V27)

A PHOTOFACT STANDARD NOTATION SCHEMATIC



SARKES TARZIAN TUNER

A PHOTOFACT STANDARD NOTATION SCHEMATIC

VOLTAGE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V1B	6BH6	-.3VDC	.9VDC	OV.	6.3VAC	125VDC	105VDC	OV.
V2B	6AG5	-.6VDC	OV.	OV.	6.3VAC	120VDC	120VDC	OV.
V3B	6C4	240VDC	OV.	OV.	6.3VAC	240VDC	-3VDC§	5VDC

§MEASURED WITH VTVM.

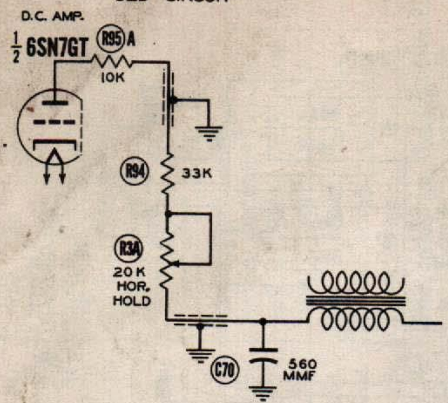
RESISTANCE READINGS

Item	Tube	Pin 1	Pin 2	Pin 3	Pin 4	Pin 5	Pin 6	Pin 7
V1B	6BH6	28KΩ	100Ω	OΩ	.1Ω	180Ω*	33KΩ*	OΩ
V2B	6AG5	1 Meg.	OΩ	OΩ	.1Ω	2KΩ*	47KΩ*	OΩ
V3B	6C4	10KΩ	INF.	OΩ	.1Ω	10KΩ†	22KΩ	470Ω

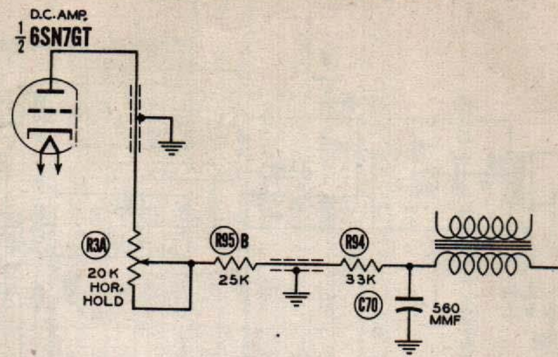
*MEASURED FROM PIN 8 of 5Y3 (V27). †MEASURED FROM PIN 8 OF 5U4 (V26).

HORIZONTAL HOLD CHANGE

OLD CIRCUIT



NEW REVISED CIRCUIT — 920 SERIES



MICROPHONICS IN GENERAL INSTRUMENT TUNER:

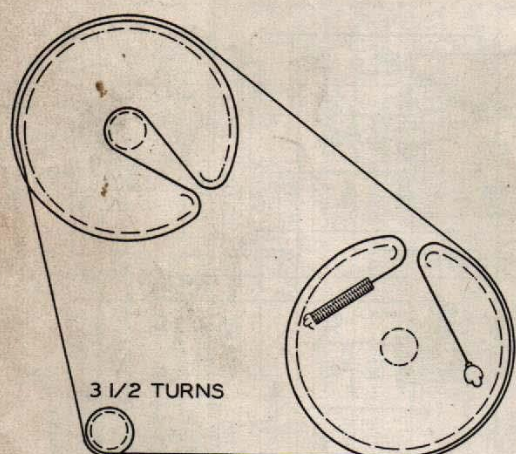
The oscillator tube in this tuner is specially selected for low microphonism. Should microphonics be experienced it is suggested the mixer and RF tube be tried as an oscillator. If these tubes are also microphonic, try other 6J6 tubes until one is found that is satisfactory.

LINE FUSE:

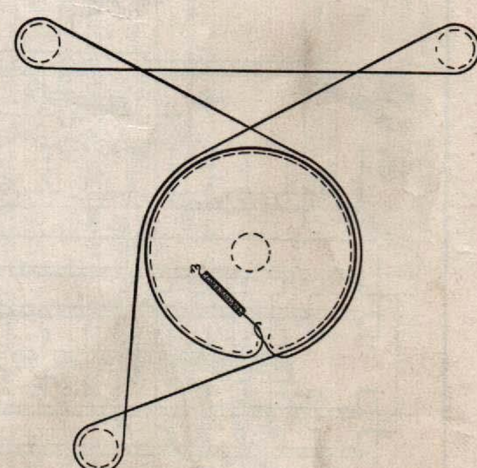
A 3AG-3 Ampere fuse has been added in series with the line. The fuse is located near the output transformer (T8) under the chassis. To gain access to the fuse remove the bottom cover from the cabinet. The fuse is mounted in a clip fuse holder.

INSUFFICIENT HORIZONTAL SIZE:

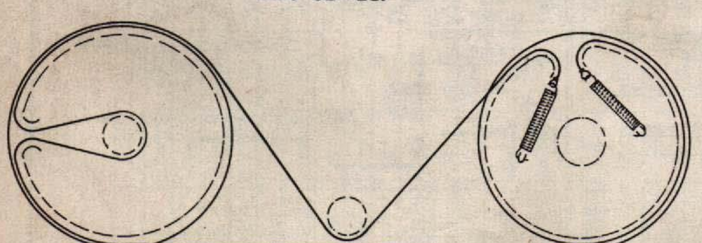
If difficulty is experienced in obtaining sufficient horizontal size in the 920 series, add a 270 MMF, 2000 WVDC mica capacitor between terminals 4 and 5 of the horizontal output transformer (T4). If this part is not available 2 - 560 MMF, 500 V. mica capacitors connected in series may be used.



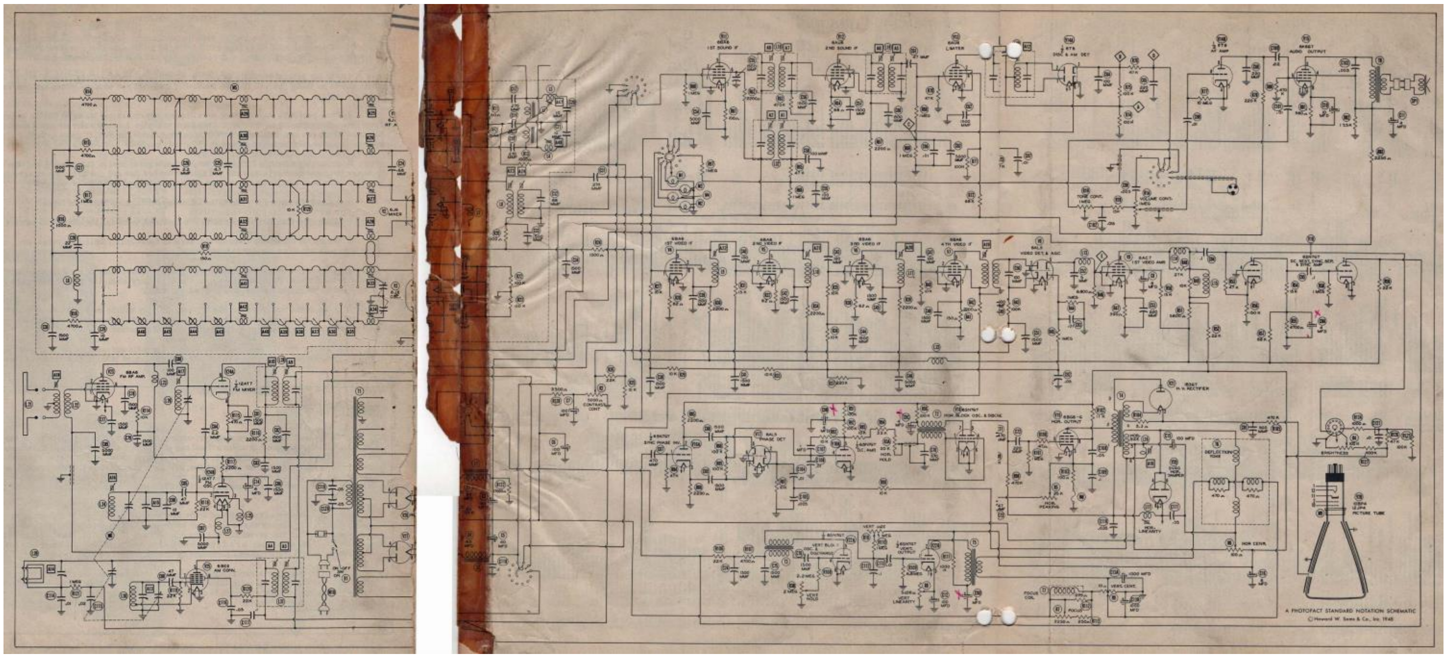
CHANNEL INDICATOR DIAL STRINGING
(900 SERIES)



MODEL 920 SERIES DIAL STRINGING



TUNING DIAL STRINGING
(900 SERIES)



PICTURE TUBE
A PHOTOFACT STANDARD NOTATION SCHEMATIC
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SERVICE POLICY

When returning radio and TV units to the factory, or parts for the purpose of repair or replacement, the following procedure will have to be followed in order to insure the best, fastest and most satisfactory compliance with your service and part replacement requests:

1. Ask for proper authority from the Garod Service Department before any returns are made, and in so doing you will list the amount of material you want to return and the exact reason for doing so.

2. Upon receiving your request, we will promptly return our Material Return Authorization Form, including shipping instructions. This form will also automatically assign a number to the shipment which you are returning; a very important factor, in that, it gives us both a mutual reference in any correspondence regarding shipments made.

3. In packing material for return shipments, a great deal of care should be taken in order to insure the merchandise being returned against further damage due to sloppy or careless packing. This care is of particular importance when the return of TV units is necessary.

In packing TV units for return, the following precautions should be taken:

1. Make sure that all shipping bolts are replaced, securing the chassis to cabinet.

2. Secure all adjustable components, such as focus coils, deflection yokes, etc., by means of the wing nuts which we employ in mounting.

3. Under no condition whatsoever should the Cathode Ray tube or Kinescope be shipped mounted in the TV unit. This tube, if its return is necessary, should be packed in the original carton supplied by the manufacturer, and shipped separately.

4. In the event that shipment of a TV chassis only will be made, the above stated precautions will have to be taken. In addition, however, as suitable carton or crate will have to be supplied to substitute the natural protection afforded by the cabinet.

Compliance with this form will completely eliminate any question as to proper disposition of any returns, therefore insuring prompt and efficient action in their replacement of repair.

WARRANTY

We warrant each new radio product manufactured by us to be free from defects in material and workmanship under normal use and service and agree either to remedy any such defect or to furnish a new part, at our discretion, provided the defective unit is delivered to us, intact, for our examination, with all transportation charges prepaid to our factory depot, within ninety (90) days from the date of delivery to the original purchaser, and furthermore that this examination shall disclose to our satisfaction that the unit is thus defective.

This warranty shall not apply to any of our radio products which have been repaired or altered in any way so as, in our judgment, to affect their stability or reliability, nor which have had the serial number altered, effaced, or removed. Neither shall this warranty apply to any of our products which have been connected otherwise than in accordance with the instructions furnished by us.

This warranty is expressly in lieu of all other warranties expressed or implied, and of all other obligations or liabilities on our part, and we neither assume, nor authorize any representative or other persons to assume for us, any other liability in connection with the sale of our radio products.

GAROD RADIO CORPORATION --- 70 Washington St., Brooklyn, 1, New York